ENGINEERING NEWS-RECORD

AUGUST 28, 1941

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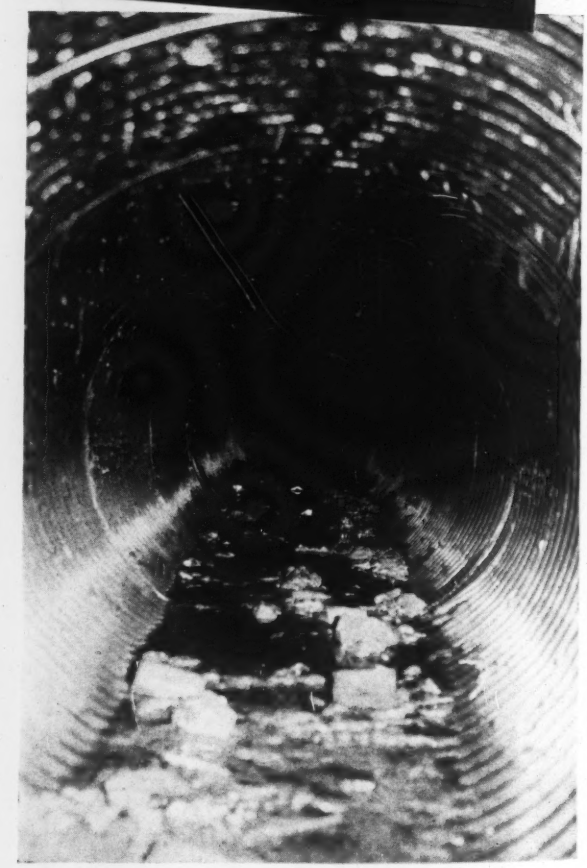
Flexible, corrugated ARMCO *Pipe has ample strength to withstand the pounding of heavy traffic. It meets every requirement for highway or railroad.*

● When culvert life isn't what it should be, here is a likely answer. Erosion, arch enemy of all drainage structures, has nibbled away the bottom of your investment and left the rest to be thrown away.

To prevent this costly waste, ARMCO engineers developed the balanced design of ARMCO Paved Invert Pipe. A smooth, thick bituminous pavement protects where the wear comes and makes the bottom endure as long as the top. Service life is often doubled under severe conditions. Maintenance costs less and you get full value out of your investment.

For extreme corrosive conditions and for even greater permanence, the special bituminous full-coating is tightly bonded to the pipe by ARMCO's Asbestos-Bonding process. It adds years of useful service.

Remember too that galvanized ARMCO Pipe already boasts an enviable service record in its own right. Now, with extra protection against erosion and corrosion, it offers double-value for your money. Specify ARMCO Paved Pipe on that next job. Meanwhile, write us for complete information. ARMCO DRAINAGE PRODUCTS ASSOCIATION, 5087 Curtis Street, Middletown, Ohio.



Here is eye evidence that the bottom of a drainage structure is the part that gets the wear. When the bottom fails, your entire investment is lost, even though three-fourths of the pipe remains in good condition.

ARMCO

ARMCO PAVED INVERT PIPE

ENGINEERING NEWS-RECORD

Devoted to Buildings, Sewers, Waterworks, Bridges, Highways, Streets, Dams, Foundations, Earthwork, Flood Control, Public Works, Irrigation, Canals, Railroads

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Vol. 127 AUGUST 28, 1941 No. 9

THIS WEEK

• Weather conditions dictated the use of a canvas tent to protect the placing and compacting of impervious earthfill core for Mud Mountain Dam, and this innovation in construction procedure is described.

• Oil transportation by pipeline is gaining new impetus as a solution to petroleum supply problems in the East, and the first line to be built—Portland, Maine, to Montreal, Canada—allows a review of construction operations that will be emphasized in coming months.

• Factors of aerial bombardment protection that should be understood and appreciated by civil engineers are discussed, and a subsequent article will review the possibilities of designing protection into structures.

• The 950-ft. hingeless arch over the gorge at Niagara Falls had to be built without falsework and the cable system used for erection and closure is reviewed in detail.

THINGS TO COME

• A group of articles in the field of waterworks engineering will recognize the annual meeting of the New England Water Works Association.

• The suspension bridge over the Ohio River at Steubenville, Ohio, was reconditioned under traffic, providing the interesting subject for an unusual article.

• Among defense plants the new buildings for airplane engine production at the Packard Motor Co. and their description present several innovations in layout, design and service facilities.

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THE *A B C* OF SAFER NIGHT DRIVING

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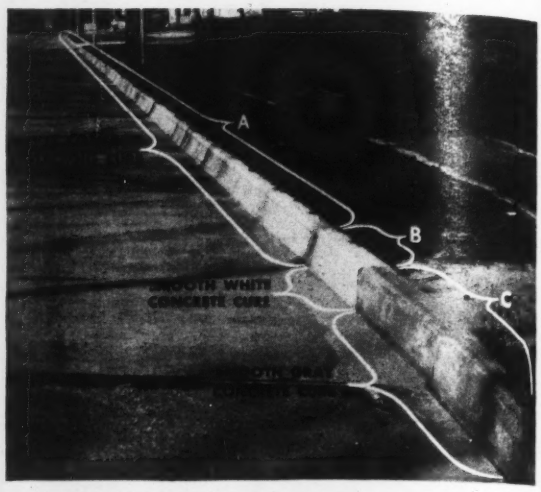
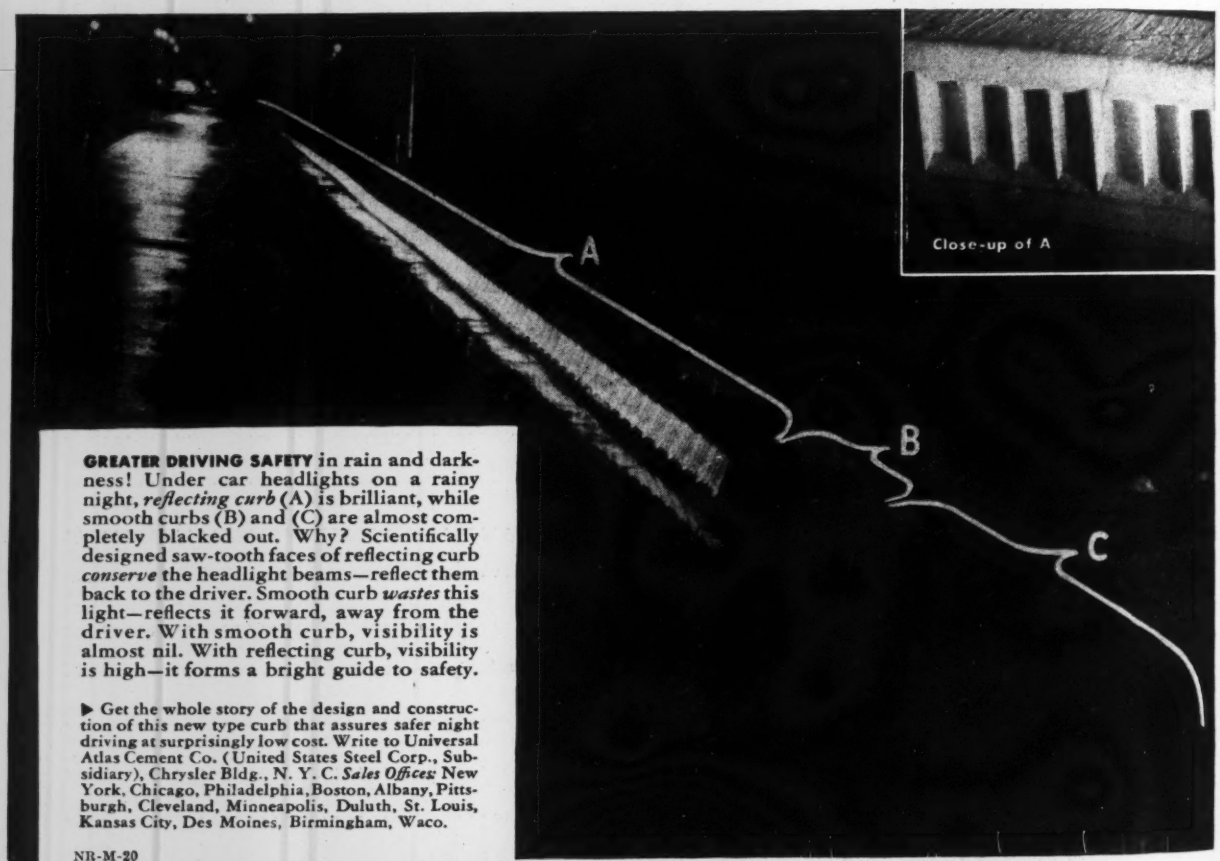
. . . Three types of curb at one location prove superiority of White Concrete Reflecting Curb



***Reflecting white* concrete curb (A), *smooth white* concrete curb (B), and *smooth gray* concrete curb (C), at one New Jersey location. In the night photograph below, note the great difference in visibility of the three curbs under car headlights on a rainy night. Contractor, Jannarone Contracting Co., Belleville, N. J.; Curb Contractor, Frapaul Construction Co., Inc., Hackensack, N. J.**



GREATER DRIVING SAFETY in rain and darkness! Under car headlights on a rainy night, *reflecting curb* (A) is brilliant, while smooth curbs (B) and (C) are almost completely blacked out. Why? Scientifically designed saw-tooth faces of reflecting curb *conserve* the headlight beams—reflect them back to the driver. Smooth curb *wastes* this light—reflects it forward, away from the driver. With smooth curb, visibility is almost nil. With reflecting curb, visibility is high—it forms a bright guide to safety.

▶ Get the whole story of the design and construction of this new type curb that assures safer night driving at surprisingly low cost. Write to Universal Atlas Cement Co. (United States Steel Corp., Subsidiary), Chrysler Bldg., N. Y. C. *Sales Offices:* New York, Chicago, Philadelphia, Boston, Albany, Pittsburgh, Cleveland, Minneapolis, Duluth, St. Louis, Kansas City, Des Moines, Birmingham, Waco.

NR-M-20

WHITE CONCRETE REFLECTING CURB

MADE WITH ATLAS WHITE CEMENT

The Week In Engineering and Construction

OPM and FWA study priority plan for defense roads

Important access routes will probably get high ratings. Plan also studied to aid maintenance work on existing highways, which may receive an A-10 rating

A plan to give priority aid to defense road building is now being worked out by OPM and the Federal Works Agency. Road builders are experiencing considerable difficulty at present getting equipment and reinforcing steel. The proposed priority plan will simplify the problem on defense roads—and make it worse, of course, on others. Details are still incomplete, but presumably highway jobs would be certified as defense work by some agency such as Public Roads Administration and then would be entitled to a rating, probably A-10.

Lacking priority ratings for their projects, many of the state highway departments are now in an almost desperate condition. A good many badly needed projects are being held up for lack of material, and in fact several half-completed bridge jobs are now at a standstill. Some relief is being granted through the project rating plan, but it is felt that a special system specifically aimed at road work is needed. When the plan will be put into effect cannot be predicted, but it is hoped for soon. In general, defense roads will probably get a A-10 rating, but important access roads will likely get something higher, such as A-3. In fact a few road jobs of great military importance may get A-1 ratings.

Meanwhile, help in priority rating for the maintenance of existing roads is expected this week, along with aid to maintenance of many other public services, when the revised maintenance and repair priority system is announced. This plan to give an A-10 rating to maintenance and repair work was issued a few weeks ago (*ENR* Aug. 14, 1941, p. 203) but was almost immediately withdrawn when it was realized that the administration of the plan would swamp Washington with paper work.

As we go to press, the revised system is expected to follow the same theory. However, the list of eligible industries and utilities, including highways will be greatly expanded. Also it will no longer be necessary to obtain OPM permission before using the plan; instead, eligible agencies will fill out an application form, send it in, and assume it has been granted. They will start using the plan and continue unless OPM orders them not to.

Big War Department building may not be built

The War Department, it appears, is going to have to abandon its plans for construction of a gigantic $35,000,000 office building (*ENR* Aug. 21, 1941, p. 267) near the Arlington memorial cemetery across the Potomac River from Washington. Money for the building was inserted over the President's objections into the recently passed supplemental defense appropriation bill. In signing the bill, the President said that he did not intend to approve the project. The appropriation is so phrased that it is believed the money can be spent on other building construction in the vicinity

Roadside sign warns drivers of dangers of highway

A new type of highway billboard that may be used either to warn drivers that a junction or other traffic interference is ahead or that their speed is excessive has been placed in operation in Minnesota north of Twin Cities at the junction of Routes 8 and 10. Called the Tellaspeed, the new sign was invented by L. T. Mork of St. Paul and George E. Sykora of Minneapolis, and is being sold by the Traffic Acutated Safety Sign Co., St. Paul. Value of the sign is based on the theory that many motorists would like to be warned that they are approaching traffic hazards or low-speed and danger zones at an excessive rate.

Operation of the sign is by two detectors, either magnetic or photo-electric cells, placed from 750 to 1,000 ft. ahead of the sign and about 40 ft. apart. Passage of a car along the highway breaks the beam of light from the first detector and lights up the warning sign. Passage of the car through the second beam makes possible determination of the car's speed for the short distance and almost instantaneously records the vehicle's speed on the sign.

Another feature of the sign is that traffic counters can be placed on the equipment to record the number of cars traveling at various speeds. In addition, at the end of any given period highway officials can determine not only the total number of cars that travel the roadway but also the speed at which they were traveling.

of Washington for the War Department.

The President based his objection to the War Department plan on aesthetic grounds, indicating that the vast bulk of the proposed structure would ruin a scenic area of the capital. However, it had been vigorously opposed in Washington, not only for this reason but because of the transportation problem.

• • •

Roosevelt acts to speed oil pipeline work

President Roosevelt Aug. 25 for the first time made use of the powers given him by the recently enacted Cole bill to speed pipeline construction. On that date he signed a proclamation granting the right of eminent domain to the Plantation Pipe Line Co. for construction of a 1,260-mile pipeline from Louisiana to North Carolina. The new line is expected to have a potential capacity of 90,000 bbl. daily and is to be devoted solely to gasoline transportation. Cost of the work estimated at over $20,000,000.

The Office of Production Management also reports that plans for the 1,820-mile pipeline from Texas to the Philadelphia-New York area (*ENR*, Aug. 14, 1941, p. 205) have been submitted to Defense Petroleum Coordinator Ickes with the work to start soon. In addition OPM reports that application has been made to secure the necessary right-of-way for a gasoline pipeline from Baton Rouge, La., to Greensboro, N. C.

BRIEF NEWS

STATE HIGHWAY Director Hal G. Sours of Ohio reports that the heavy increase in highway traffic due to the national defense program is responsible for the increasing accident rate on that state's rural roads. He points out that highway accidents have caused 371 deaths outside of municipalities in his state during the first six months of this year, which was 73 more than were killed in the comparable period a year ago.

THE ASHLAND (Ky.)-Coal Grove (Ohio) bridge across the Ohio River was made toll free early this month when the span's $904,000 bonded indebtedness was paid off. A ceremony was held in Ashland celebrating the event.

A BILL REQUIRING any toll bridge purchased by the Commonwealth of Pennsylvania for less than $300,000 to be made a free bridge immediately has been vetoed by Governor James. He said the measure would favor the relatively small group of motorists using such bridges and discriminate against the much larger percentage of motorists forced to continue to pay toll on spans where the cost of purchase exceeds $300,000.

THE SEMI-ANNUAL written examination for registration of architects and professional engineers to practice in the state of Wisconsin will be held Sept. 9-12 for architects and Sept. 10-12 for professional engineers in the mechanical engineering building at the University of Wisconsin, Madison. Applications for examination should reach the board of examiners not later than Aug. 30. For further information write C. A. Willson, acting secretary, Wisconsin Registration Board of Architects and Professional Engineers, State Capitol, Madison.

I. J. BROWDER, director of personnel employed by the State of Alabama, has announced increases for the Alabama state highway department employees' salaries ranging from $5 to $15 per month. This is an endeavor to halt the numerous resignations of employees to accept other positions.

THE BIDDER CLOSEST to the site will receive future Department of the Interior contracts, which, of course, includes those for Bureau of Reclamation work, in the case of receipt of identical bids, according to a policy adopted by Secretary Ickes last week. This is to reduce to a minimum transportation requirements in connection with materials purchased, and thus will be a means of easing the burden placed by defense demands on transportation facilities.

Several years ago, as a part of an unremitting campaign against the practice of identical bidding, Secretary Ickes ordered Interior agencies to award contracts, when identical bids were received, to the shipper farthest removed from the delivery point.

FSA uses trailers for defense housing

Trailers of the type shown above are being used by the Farm Security Administration on eleven projects scattered over the nation to provide housing for defense workers. Cost per dwelling unit with the trailer camps is $1,084, including underground services, utilities, and the camp's central utility building. The trailers, which are placed 50 to the acre, are heated with gasoline stoves, and are all supplied with electric current. Water and sewage facilities are located in the central building, which has hot water, laundry tubs, toilets, wash basins, and showers. One central unit is built for every 60 trailers.

The water supply is obtained from a municipal supply or from wells at the camp. Sewage disposal is handled by a connection to a municipal sewer or by a septic tank.

Rents vary from $6 to $8 monthly, including light but not heating fuel.

• • •

C. H. Mitchell dies; former Toronto engineering dean

Brig. Gen. Charles H. Mitchell, 69, who retired in June, 1941, as Dean of the Faculty of Applied Science and Engineering at the University of Toronto, died in Toronto, Ont., Aug. 26. Gen. Mitchell, a past president of the Engineering Institute of Canada, worked for many years as a consulting engineer in Toronto and as a member of the Canadian Board of Engineers, studying development of the St. Lawrence River.

Following his education at the University of Toronto, Gen. Mitchell served as assistant city engineer at Niagara Falls, N. Y., and then as city engineer of Niagara Falls, Ont. From 1900 to 1906 he was principal assistant engineer of the Ontario Power Co.

Gen. Mitchell served with the Canadian Expedition during the World War, advancing to the rank of Brigadier General, and soon afterward was made Dean at Toronto University.

He was the author of a number of books and articles on hydro-electric power generation.

No collective bargaining on Michigan road work

A county board of road commissioners, or any other arm or agency of the government expending public funds, has no authority to bargain with any one individual or group of individuals to the exclusion of other individuals or groups, according to a ruling of the Attorney General of Michigan in answer to questions put to him by the Michigan Association of Road Commissioners and Engineers. The Attorney General stated that, "In the industrial field, collective bargaining has been adopted as a method of solving private labor problems. However, because of fundamental concepts and principles of government, it is obvious that collective bargaining cannot apply to public employment and public labor which involve expenditure of public funds. The moment any agency of government recognizes any individual or group of individuals, be it capital or labor, as superior to any other group or individual, government for all on an equal basis ceases and we would have a government, not by the people, but by organized minorities which would only engender bitterness and result in chaos, and defeat the very purpose of government.

"A strike of public employees called for the purpose of coercing public officials into exercising discretionary powers vested in them by law in a manner satisfactory to the strikers is in reality a form of rebellion against the government."

The Attorney General went on to quote the late Justice Cardozo who in *People vs Crane* said "Since the government in expending public monies is spending the monies of its citizens, it may not by arbitrary discrimination having no relation to the public welfare foster the employment of one class of its citizens and discourage the employment of others." Also quoted was President Roosevelt as stating in a letter to the National Federation of Federal Employees: "All government employees should realize that the process of collective bargaining, as usually understood, cannot be transplanted into public service."

• • •

California leads U. S. in water power capacity

The Federal Power Commission has announced that the entire capacity of water power plants in the United States and territories at the beginning of this year was 19,015,101 hp.

California, with a total installed capacity of 2,438,261 hp., led the states. New York ranked second with a total of 1,843,787 and Washington was third with 1,214,504.

The ten states with the next highest capacity are: Alabama, 1,145,300 hp., North Carolina, 1,033,320; South Carolina, 838,549; Nevada, 708,830; Tennessee, 694,406; Maine, 637,527, and Pennsylvania, 607,303.

The largest net increases in the year were shown by Tennessee with 106,125 hp.; North Carolina, 78,875; Oregon, 72,875, which brought its total to 786,793; Pennsylvania, 42,424, and New Mexico, 34,390, increasing its total to 35,683.

Priority given for steel for Connecticut spans

Regular deliveries of structural steel and other materials needed in the construction of the new Hartford-East Hartford Bridge over the Connecticut River and the New London-Groton bridge over the Thames River appear assured by the granting of A-2 priority classification ratings to the projects by the Office of Production Management at Washington. Both projects have been certified by the Army and Navy as vital to national defense. Both are highway bridges, and serve important areas containing defense industries or naval bases. Approaches are included in the priority material grants.

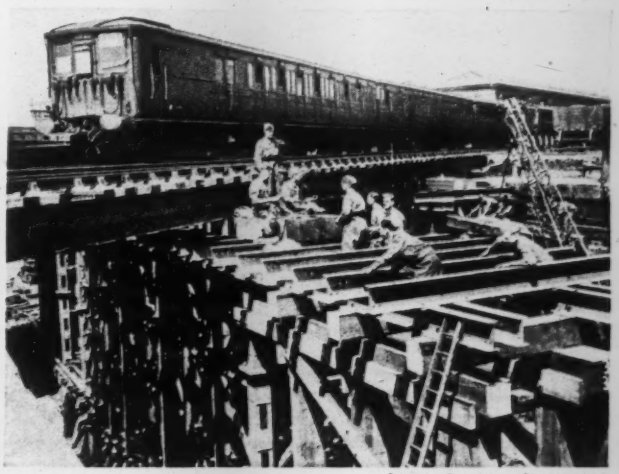
• • •

Bids received for record Kentucky highway bridge

When bids were opened Aug. 23 for a new highway bridge to be built at Clay's Ferry, Ky., across the Kentucky River on U. S. Highway 25, the Mt. Vernon Bridge Co., Mt. Vernon, Ohio, was low bidder for the steel superstructure work with a bid of $589,432. For the substructure work the Massman Construction Co., Kansas City, Mo., was low with a bid of $345,847.

The new bridge will be unusual in that it will be more than 240 ft. above low water or the highest bridge in Kentucky. The crossing is also notable in that it contains the state's longest continuous truss, a three-span unit of 320-448-320 ft. (*ENR*, April 10, 1941, p. 519.)

The work is being done by the Kentucky state highway department.



British Combine Photos Ltd.

Bridge repairmen keep London trains running

According to Col. L. V. Murrow's report on British transportation in wartime (ENR June 19, 1941, p. 945), relatively few bridges have been hit by bombs, and even when hits have occurred the bomb has frequently merely punctured the deck without wrecking the structure. Not so fortunate was the bridge in London, pictured above, where a bomb registered an abutment hit that blasted the girders from their supports. Too badly battered for quick replacement, the old bridge was scrapped, and an emergency structure substituted by the Pioneer Corps and the Royal Engineers. Three spans of rolled beams were substituted for the original single span girders, the new piers being built up of prefabricated steel and timber bents. Trains were soon running, according to the British censor.

WASHINGTON HIGHLIGHTS

APPLICATIONS for Title VI (no down payment) FHA loans for private defense housing are pouring in at a rate of $4,000,000 per week, and it is already obvious that the authorized limit of $100,000,000 on such loans will be reached long before next July. A Senate committee has therefore reported favorably a bill raising the limit to $300,000,000. Under Title VI FHA will insure loans to speculative builders up to ninety percent of the sale price of the house. The house may then be sold to an occupant with the down payment collected over a period of years. Such loans—limited to houses in defense areas costing less than $4,000 ordinarily cover the full cost of construction, and thus remove all risk from the builder.

AID to Latin-American governments in the construction of military bases is to be provided out of lease-lend funds. Uruguay is now negotiating for financing of a $17,000,000 air base at the mouth of the River Plate, and it is confirmed in Washington that similar aid is to be given to other South American countries.

WHAT IS probably the largest single order for cement ever placed at one time in this country has been awarded by the Panama Canal Commission for cement to be used in the new lock system. Six million barrels are being bought, 4,000,000 from Trinity Portland Cement, of Chicago, at $5,400,000 and 2,000,000 from Lone Star for $2,790,000. This order exceeds the 5,800,661-bbl. purchase of cement for Shasta Dam and the 4,000,000 bbl. order for Grand Coulee Dam made by the Bureau of Reclamation.

McLaughlin Air Service Photo

Runways of Asheville-Hendersonville airport extended

The Asheville-Hendersonville (N. C.) airport 1½ miles east of the town of Fletcher is being improved as one of the defense projects certified by the War and Navy departments. With the $300,000 original project, which was completed in 1938, the airport was graded and drained and one runway 3,100 ft. long by 500 ft. wide was constructed with a 100-ft. wide asphalt center strip. In addition another 3,200 ft. long and 500 ft. wide, runway was graded, drained, and sodded. With the work now being carried out, the two existing runways will be extended so that both will be 4,000 ft. in length and a new runway of the same length graded and drained.

For the new project the WPA is providing $233,000 while the sponsors have pledged $237,000, including $172,000 supplied by the Civil Aeronautics Administration. The new construction, as with the original work, is sponsored by the cities of Asheville and Hendersonville and the county of Henderson.

Supervising the new work are: A. F. Weaver, Jr., WPA district manager at Asheville, N. C., and J. Cecil Grice, project engineer.

New plants and lower prices for aluminum

The Aluminum Company of America announces that negotiations have been completed and a contract made with Defense Plant Corp., acting for the United States, for the construction and operation of an alumina plant in the state of Arkansas with an annual capacity of 400,000,000 lb., and for the construction and operation of three aluminum smelting plants. The three latter plants are: one at Massena, N. Y., with an annual capacity of 150,000,000 lb.; another in the Portland, Ore., district with an annual capacity of 90,000,000 lb., and a third in Arkansas with an annual capacity of 100,000,000 lb. Designs for the necessary buildings have been under way since July 15 of this year.

The Aluminum Company also announces that the price of ingot aluminum will be reduced from 17 to 15c. per lb. on shipments made after September 30, 1941, and that reductions will be made in the price for fabricated aluminum in conformity to the ingot price reduction. The present price reduction is the fourth since March, 1940, when the ingot price was 20c. per lb.

The production of approximately 340,000,000 lb. per year from the plants covered by the contract with the Defense Plant Corporation when added to the production of the Aluminum Company's own plants of approximately 760,000,000 lb. per year will give the Aluminum Company an output of approximately 1,100,000,000 lb.

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Missouri to register architects and engineers

Missouri, one of the few states not now having a registration law for engineers, is to begin the registration of architects and engineers on Oct. 10 of this year. A law putting such registration into effect was passed recently by the state legislature and was signed on Aug. 4 by Governor Donnell. Registration of the two professions is covered by one bill which carries the usual "grandfather clause" covering registration of men now practicing in either profession. The registration act sets up a seven-man registration board consisting of three engineers, three architects and a chairman who may be either an engineer or an architect.

The legislative committee that handled the drafting and presentation of the bill consisted of Roy Averill and E. E. Howard, representing the Missouri Society of Professional Engineers, and A. W. Archer, representing the Missouri Association of Architects.

Denver plans addition to West Slope water supply

Plans for diversion of West Slopes water from the Blue River through a Continental Divide tunnel into the present South Platte River system of Denver's water supply have again been revived by an appropriation of $50,000 for further studies and surveys. The Blue River project would take water from that valley near Dillon, Colo., and conduct it through a 23-mile tunnel to the South Platte near Grant on the East Slope. Preliminary plans are for an 8x10-ft. tunnel that would carry a flow of 800 cfs. Later the bore could be enlarged to 14x16 ft. to carry twice that flow. The pioneer bore would be left unlined, except in bad ground, where full-size lining would be installed.

The Blue River project was first surveyed in 1924, but start of work was delayed by completion of the Moffat R. R. tunnel, whose pioneer bore was utilized by Denver for diversion of West Slope waters. Then a smaller project, the Williams Fork diversion through the 3-mile Jones Pass tunnel, was next completed, leaving Blue River for some future time. The U. S. Bureau of Reclamation is also considering trans-mountain diversion of the Blue River as an irrigation project. Possibly the city and the bureau may get together on a joint project.

Meanwhile, the city is extending the collecting works for the Moffat tunnel diversion by driving the 3-mile Arrow tunnel north from the intake to tap the headwaters of Ranch Creek. This job was let recently under a peculiar contract. Two miners took the work as city employees, and all workmen will be paid directly by the city. The contractors will receive $6.85 per cu. yd. for excavation and $35 per M bd. ft. for timber placed. The 6x7-ft. tunnel will be left unlined except for ground support, and is to be completed by Oct. 1, 1942. The city furnishes all equipment, supplies and materials.

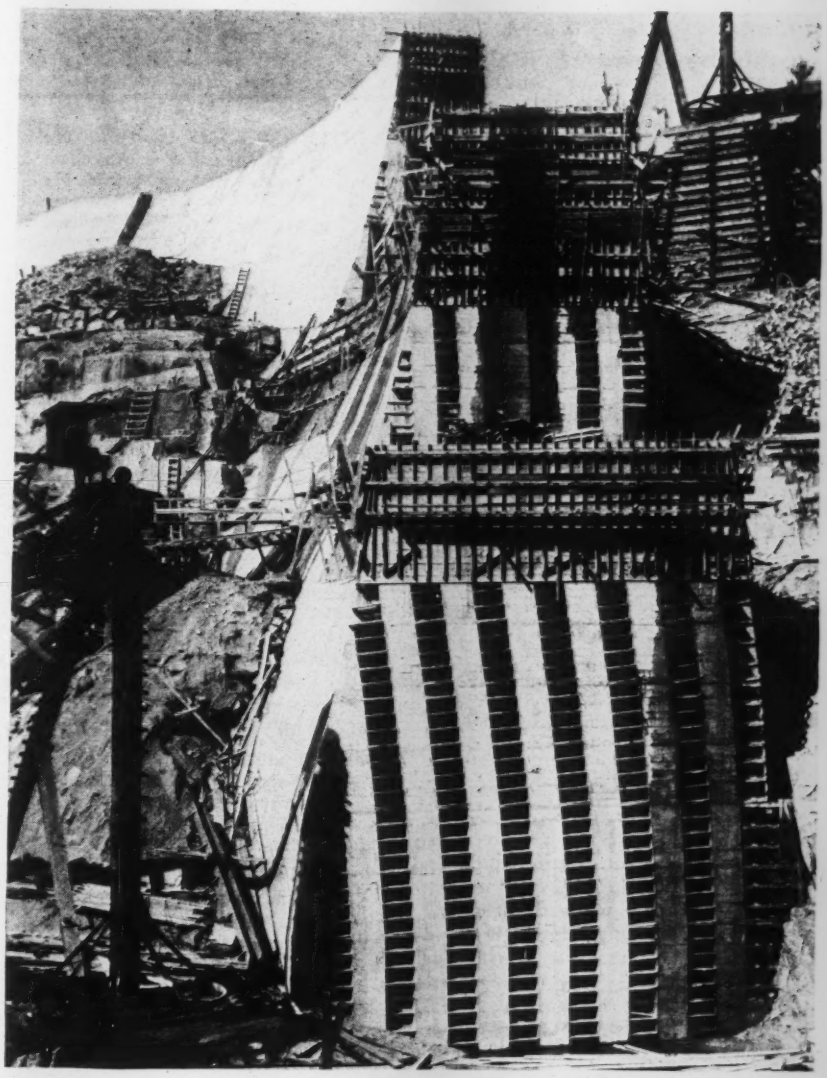
• • •

Legalities restrict labor stabilization agreement

Although it was generally understood among negotiators of the construction labor stabilization agreement that the agreement would be incorporated by the President in an executive order, this has not yet been done, and it looks as if the omission might cause some difficulties. There are two problems:

First, construction wage rates are set legally (Bacon-Davis Act) at the levels prevailing in the area where the work is done. The new agreement, however, would base wage rates on prevailing practice in the area from which labor is to be drawn; in the isolated areas where much defense construction is being done, the agreement would thus call for a higher level than does the Bacon-Davis Act. It is understood that the Labor Department is willing to revise its wage-determination procedure to conform to the agreement, but more legalistically minded agencies such as the Accounting Office, which has to approve all payments, does not agree with this.

Second, there is the matter of overtime. The President's statement on labor policy, incorporated in a note to Congress last year, is interpreted by government lawyers as having the force of an executive order. The statement called for overtime pay in accordance with prevailing practice, while the agreement would stabilize overtime pay at time and a half. This conflict is not expected to cause much trouble as regards future or cost-plus contracts, but it seems to make nearly impossible the reopening of existing lump-sum contracts. Many such contracts are based on double time for overtime, others on straight time. Either arrangement can cause trouble in an area surrounded by standardized jobs.



Arch dam for hydro power in British Columbia

Scheduled for completion some time in October is the Lois River Dam under construction in British Columbia for the Powell River Co. This picture was taken last spring before concreting had started on a section in the river channel which was left open to pass stream flow. The dam, built to provide storage for the company's water power development, is a variable-radius arch with a maximum height of 180 ft. and a crest length of about 640 ft. The base at the center section is 37 ft. wide and the crest width is 8 ft. The dam was designed by B. C. Condit, consulting engineer, Oakland, Calif. and the construction is being done under contract by Stuart Cameron and Co., Vancouver, B. C.

Concrete barges and ships built by Great Britain

That the British Navy Department is building a large number of reinforced-concrete barges of 180 to 200 tons carrying capacity is stated in "The Engineer" (London) of July 18, in an article by Rolt Hammond. Mr. Hammond also states that in the replacement of lost tonnage "there is no doubt that the concrete ship will play an important part." Technical details of the barges are held secret, but Mr. Hammond gives the following particulars as to their construction:

"These vessels have endured gruelling tests for seaworthiness and water-tightness with marked success. They are built up of precast slabs made in a yard some distance from the slipways, the first operation consisting of laying the bottoms. These are formed of the slabs arranged in regular fashion and subsequently connected together by means of narrow concrete stiffening members cast in place. Slabs for walls and decks are joined in a similar manner, and in all cases the steel reinforcement projects beyond the edges of the slabs, so as to bond the slabs together like a monolith. For example, the sides of the barge consist of concrete slabs which are connected at their lower edges to the bottom of the barge and at their vertical edges to one another. Little skilled labor is required, and the barges are launched sideways without difficulty."

As to concrete ships, Mr. Hammond states that during the first World War 150,000 deadweight tons of concrete shipping was built in Norway, Great Britain, the United States and other countries. He cites N. K. Fougner as the pioneer and credits him with the building of some thirty vessels. Two British ships built in 1919 and operated in the Baltic service were examined in 1934, after 15 years. There were unimportant hair cracks in the decks, due to the heat from the boilers, but there was neither weeping nor condensation in the hull, and even the bilges were dry. Reference is made to four cargo ships of 3,000 tons deadweight and eight oil tankers of 6,500 tons completed by the U. S. Shipping Board before the armistice.

As to construction of concrete ships at the present time, Mr. Hammond points out that the concrete of 1941 is very different from the material used 23 years ago:

"In 1918 the ultimate compressive strength of good concrete was about 2,000 lb. per sq.in. and a working stress of 750 lb. was considered somewhat daring. Today, however, a compressive strength of 5,000 to 6,000 lb. is expected in normal structural work, and greater strength is often obtained."

JOBS OF THE WEEK

SHELL AND BOMB LOADING PLANT, Carbondale, Ill.

Hunkin-Conkey Construction Co., Cleveland, O., got the contract for constructing a shell- and bomb-loading plant at Illinois Ordnance Plant 8 mi. east of Carbondale on a 20,000-acre site in Jackson and Williamson counties. The estimated cost of the work is $27,000,000. Sherwin-Williams Co., Cleveland, Ohio, will operate the plant for the War Department.

SHELL-LOADING PLANT, Parsons, Kansas

Peter Kiewit Sons Co., Omaha, Neb.; George W. Condon Co., Omaha, and Paschen Bros. Construction Co., Chicago, have been awarded a joint contract for constructing a $20,000,000 shell-loading plant at Parsons, Kan., for the War Department. Consoer, Townsend & Quinlan and Battey & Childs, all of Chicago, are engineers for the project. The J-M Service Corp., a subsidiary of Johns-Manville Corp., New York, will operate the plant.

CEMENT, Canal Zone

Panama Canal Commission, Washington, D. C., awarded a $5,400,000 contract for supplying 4,000,000 bbl. of portland cement for the third set of locks for the Panama Canal to the Trinity Portland Cement Co., Chicago, Ill., and a $2,790,000 contract for supplying 2,000,000 bbl. to the Lone Star Cement Co., New York, N. Y.

TERMINAL MARKET, Brooklyn, N. Y.

Federal Construction Corporation, New York, has been awarded a $1,067,700 contract by the Department of Public Works, Municipal Building, New York City, for the construction of the Brooklyn terminal market. The plumbing contract for the project went to Astrove Plumbing & Heating Co., Brooklyn, at $92,170; the electrical work was awarded to the Bank Electric Co., New York, at $51,200; the heating contract to Jacobs Engineering Co., New York, at $5,127; and the sewer construction to A.F.M. Construction Co., Brooklyn, at $29,950.

GEAR PLANT, Lynn, Mass.

Turner Construction Co., Boston, Mass., got the contract for constructing a one-story plant for manufacturing gears for the Navy Department. The cost of the undertaking is estimated at between $2,000,000 and $3,000,000. General Electric Co., Lynn, Mass., is the owner for the work, which will be financed by the Defense Plant Corp.

SYNTHETIC AMMONIA PLANT, Freeport, Texas

Dow Chemical Company, Midland, Mich., will construct a plant to produce synthetic ammonia at the rate of 150 tons daily. The project's estimated total cost is $11,000,000 and construction will be undertaken by The Austin Co., Cleveland, Ohio, and The M. K. Kellogg Co., New York. The Defense Plant Corp. will finance the undertaking.

DEFENSE HOUSING PROJECT, Philadelphia, Pa.

J. A. J. Construction Co., Brooklyn, N. Y., has been awarded a contract by the Philadelphia Housing Authority for the construction of three defense housing projects. The successful bids were for a 700-unit project at $2,997,000; a 500-unit project at $1,942,000; and a 200-unit job at $793,000. The total cost of all the work, which will be financed by USHA, is $5,732,000. H. R. H. Construction Co., New York, was low bidder at the July 24 opening. This latter company was unable to take all three projects and J. A. J. Construction, the second bidder, offered to take the entire job at the low bid.

LOW-COST HOUSING, Philadelphia, Pa.

M. Shapiro & Son Construction Co., New York, was low bidder at $4,387,000 for constructing 1,000 residences for the Philadelphia Housing Authority.

WIND TUNNEL, Moffett Field, Calif.

Pittsburgh-Des Moines Steel Co., San Francisco, Calif., was low bidder with a bid of $6,164,320 for constructing a fabricated-steel wind tunnel at Moffett Field. The National Advisory Commission for Aeronautics, Ames Laboratory, Moffett Field, is doing the work.

ARMY BASE TRAINING SCHOOL, Columbus, Miss.

V. P. Loftis Co., Charlotte, N. C., bid low with a bid of $4,123,791 for constructing an army base training school when the U. S. Engineers opened bids Aug. 20. E. C. Van Keuren, Birmingham, Ala., is architect for the work and J. W. Goodwin Engineering Co., Birmingham, engineer.

DEFENSE HOUSING, Seattle, Wash.

Western Construction Co., Seattle, was the low bidder at $1,704,000 for the construction of a 500-unit defense housing project being carried out by the Seattle Housing Authority. Priteca & Young, Seattle, are architects for the job. USHA will finance the work.

NOTE—Additional bidding and contract news on over 800 projects large and small appear in the Construction News section beginning on page 109.

OBITUARY

WALTER P. RICE, 85, founder of the Cleveland Engineering Society, died Aug. 21 at Atlantic City. Mr. Rice began his engineering career as assistant in the Cleveland city engineer's office and was city engineer from 1887 to 1890 and from 1893 to 1895. In the 1880's he served with the U. S. Engineers on harbor work on Lake Erie and once served as chief engineer for the state of Ohio. Mr. Rice in 1901 went into private consulting practice. He was president of the Cleveland Engineers Society from 1892-93.

GEORGE J. BULFORD, JR., 38, architect for the Jennings-Lawrence Co., engineers of Columbus, Ohio, and engineers on the Ravenna, Ohio, ordnance work, died at Ravenna Aug. 20.

LEONARD K. HOLLINGSWORTH, 64, who as erecting engineer for Allis-Chalmers Mfg. Co. supervised the erection of some of the country's largest steam turbine and pumping engine installations, died Aug. 20 in Milwaukee. He joined Allis-Chalmers in 1906.

GEORGE E. MORRIS, architect of Elgin, Ill., died Aug. 20 at the age of 66.

RODNEY MESSNER, 49, surveyor for the last 14 years for Marin County, Cal., died Aug. 12 in San Rafael, Cal. Prior to his election as surveyor for Marin County, he was engineer for the California highway department.

CHARLES E. BAISLEY, 76, former general manager of the Great Lakes Engineering Works and builder of the Michigan Central Ry. tunnel under the Detroit River, died Aug. 25 in Detroit, Mich. Mr. Baisley had been associated with the Great Lakes Engineering Works for 35 years prior to his retirement last January.

• • •

Court rule would cut Louisiana road funds

The Louisiana state highway department reports that a court decision of Aug. 11 makes necessary transfer of $1,168,000 of highway funds to the state welfare department work. This may result in decided curtailment of that state's road program.

The decision is the result of a suit brought by taxpayers questioning the use of that state's 7-cent gasoline tax. The major point in question relates to the effective date of a state act limiting the highway department to proceeds from only four cents of the gasoline tax as against five cents.

The highway department plans to appeal the case.

• • •

Bankhead Tunnel traffic heavy during July

During July 100,179 vehicles or an average of 3,230 automobiles per day used the Bankhead Tunnel at Mobile, Ala. Revenue for the month totaled $26,717 while expenses were $4,472. The average daily receipts exceeded the most optimistic expectations of tunnel officials; even better receipts are expected during August and September.

• • •

Carlton Tunnel powder

In these pages July 31, 1941, p. 140, it was erroneously stated that over 10,000 lb. of powder was required in the construction of the Carlton Tunnel at Cripple Creek, Colo. The correct figure is 1,098,150 lb. for excavation of the 6-mile 10x11-ft. unlined bore.

CONTRACTS AND CAPITAL

ENGINEERING CONSTRUCTION awards for the week, $124,233,000, climbed sharply from a week ago to gain 55 percent over last week's total, and to top the volume for the corresponding 1940 week by 116 percent.

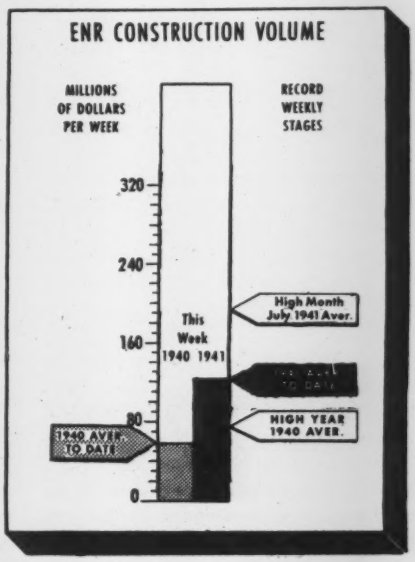
Public construction is responsible for the increase, gaining 187 percent over the 1940 week, and 71 percent over a week ago. Private construction is 0.5 and 12 percent lower, respectively, than last week and last year.

The week's awards bring 1941 construction to $4,329,627,000, a 103 percent gain over the total for the 35-week period in 1940. Private awards, $893,742,000, are 41 percent above the period last year, and public construction, $3,435,885,000, is 129 percent higher due to the 357 percent increase in federal work.

In the classified construction groups, gains over last week are in sewerage, industrial and public buildings, and unclassified construction. Increases over the week last year are in bridges, commercial and public buildings, earthwork and drainage, streets and roads, and unclassified.

New capital for construction purposes for the week totals $31,156,000, a 90 percent increase over the volume for the corresponding 1940 week. The current week's financing is made up of $15,105,000 in RFC loans for private industrial expansion, $10,000,000 in corporate security issues, $6,016,000 in state and municipal bond sales, and $35,000 in RFC loans for public improvements.

New construction financing for the year to date, $5,403,461,000 is 172 percent higher than the $1,985,331,000 reported for the 35-week period last year.



CONTRACTS
(Thousands of dollars)

	Week Ending Aug. 29 1940	Aug. 21 1941	Aug. 28 1941
Federal	$8,452	$45,599	$80,428
State & Municipal	28,674	16,522	25,836
Total public	$37,126	$62,121	$106,264
Total private	20,318	18,040	17,969
TOTALS	$57,444	$80,161	$124,233
Cumulative 1941 (35 weeks)			$4,329,627
1940 (35 weeks)			$2,134,721

Note: Minimum size projects included are: Waterworks and waterways projects, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1940 35 weeks	1941 35 weeks
NON-FEDERAL	$1,176,759	$1,005,872
Corp. Securities	158,280	300,724
State & Mun.	599,819	326,738
U.S.H.A. loans	118,501	30,399
R.F.C. loans	116,159	84,511
R.E.A. loans	.....	100,500
Federal Aid—Hwy.	184,000	163,000
FEDERAL	$808,572	$4,397,589
TOTAL CAPITAL	$1,985,331	$5,403,461

FHA MORTGAGES

	Week Ending Aug. 24 1940	Aug. 16 1941	Aug. 23 1941
Selected for appraisal	$28,429	$31,206	$28,682*
Cumulative 1941 (34 weeks)			$990,726*
1940 (34 weeks)			$848,751

* Subject to revision.

ENR INDEX NUMBERS

Index Base=100		1913	1926
Construction Cost	Aug. '41	260.41	125.18
Building Cost	Aug. '41	212.45	114.84
Volume	July '41	635.	278

Comment and Discussion

Readers' opinions on matters that concern engineers and contractors

Labor Speaks on Strikes

Sir: In the editorial "Strikes on Defense Construction," (*ENR*, May 22, 1941, p. 802), the wording is misleading in that it states that "less than one percent of the 40 million man-days required for the Army's emergency building program has been lost by work stoppages due to labor troubles." In the news item on p. 793 of this same issue, the War Department's official figure is given as "three one-hundredths of one percent." While three one-hundredths of one percent is, of course, less than one percent, the average reader will fail to appreciate that 33 times as many man-hours could have been lost due to labor trouble, and the amount would still be under one percent. In view of the fact that three one-hundredths of one percent represented 14,875 man-days, 33 times this figure would make an enormous difference, and still be less than one percent.

Sarcastic reference is made in the editorial to the alleged activities of labor unions in admitting to membership unskilled and unqualified men who will henceforth insist upon being classed as skilled mechanics and paid accordingly, and to the fact that unions exact tribute from such workmen in the form of excessive fees. If you will take time to investigate this matter, we think you will find to your complete satisfaction that the contractor or employer is the judge in every case of the qualifications of the man he is employing and that no labor union will insist that a man be retained on the contractor's payroll when he is not competent or qualified to perform the services for which he is employed.

Therefore, if unqualified mechanics have been admitted to membership in local unions in districts where defense projects are under construction, we believe that investigation will show that such unqualified mechanics are retained on the contractor's payroll when qualified men are discharged for reason of such contractor having secured his job on a time and material basis; where contracts are awarded under these conditions, it is to the contractor's interest from a financial standpoint to employ men whose lack of experience requires much extra time and an excessive amount of waste materials.

Upon further investigation we think you will also find that such contractors crowded the labor unions in every way possible for men, insisting that they admit to membership unqualified workmen in order to supply their demands, after which such unqualified workmen were retained on the job and competent mechanics discharged.

In the statement in your editorial that "the construction industry and the consumers of its products will pay installments on the cost of this labor peace for many years to come," we feel that an uncalled-for injustice has been done to the laboring people of America.

J. EARL WELCH
Secretary
Springfield Building and Construction Trades Council, Springfield, Ill.

The Problem of Bracing Design

Sir: The article "Bracing—When and How Much?" (*ENR*, May 22, 1941, p. 818) suggests the necessity for a working basis of bracing design. In the issue of March 31, 1938, p. 467, formulas were given to determine the magnitude of lateral thrust produced by compression members which the writer has used in his practice. Since two typographical errors appeared in the formulas there expressed, they are repeated here with corrections:

Lateral thrust of compression flanges:

$$T = S_2 \frac{f_2 - f}{L} \qquad (1)$$

$$T = \frac{W}{n} \sqrt{I_2/I_1} \qquad (2)$$

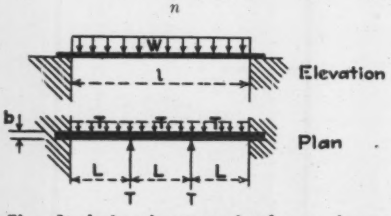


Fig. 1. Lateral supports for a beam are spaced according to a limiting value of L/b.

Lateral thrust of columns,

$$T = \frac{S\,(f_1 + f_2)}{L} \qquad (3)$$

$$T = 9/8 f_1/L \sqrt{A\,I} \qquad (4)$$

The symbols used in these expressions are defined in the original article. The derivation of the formulas, being somewhat lengthy, was not reproduced, but the writer would be glad to furnish it to anyone interested in the detail analysis.

To utilize the full design fiber stress in a beam or girder, sufficient lateral support must be provided at intervals of L feet (See Fig. 1) to limit the ratio to the specified L/b under the A.I.S.C. or other reduction formula as determined by Eq. 1.

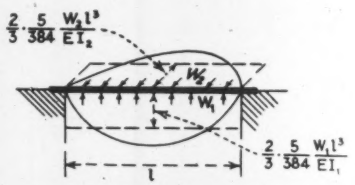


Fig. 2. Lateral force may be computed by assuming equality between work required to deflect beam vertically and horizontally.

In computing the section modulus of the compression flange of a rolled structural steel girder, it can be assumed as a rectangle with the vertical axis through the center of gravity of the section. If instead of a uniform vertical load, the girder is subjected to a series of concentrations, a similar analysis will give the potential lateral forces either at or between the loading points to provide adequate lateral bracing against buckling of the compression flange.

Assuming that the energy consumed in deflecting the girder horizontally would not exceed the work done in deforming the beam vertically results in Eq. 2 as graphically illustrated in Fig. 2. Eq. 2 is the expression for the total uniformly distributed lateral force which would produce the buckling of the compression flange. Dividing by n, the number of lateral braces, gives the required force to be resisted in each brace, as an alternate method.

Equations 3 and 4 are the expressions for the potential force which determines the lateral resistance that must be applied to a column at the floor level either as a compression strut or a tension tie to establish the unbraced length and slenderness ratio of the column corresponding to the permissible design stress on the

column section. Similar calculations would be made to determine the bracing in both horizontal directions. Fig. 3 graphically illustrates the assumption of the column as a continuous beam. The equations provide alternate methods for calculating the lateral column forces to be resisted.

The expression for the magnitude of thrust in Eq. 3 is based on the determination of the uniformly applied load W required to produce the bending moment which will develop a total stress $(f_1 + f_2)$ due to combined column and bending action on the span 2L.

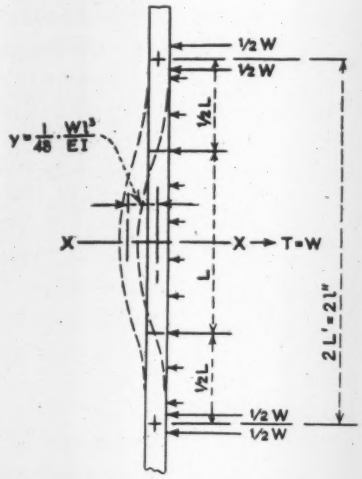


Fig. 3. In computing lateral forces on columns, such members may be assumed as continuous beams.

Eq. 4 is the measure of the force that must be applied at section x-x, Fig. 3, on the assumption that the energy stored in the column by vertical deformation or shortening under axial loads is completely released to bend the column laterally. The maximum lateral bending effort would result from the assumption that all the stored energy from vertical deformation would be utilized in bending the member. There is an additional amount of energy consumed in a tendency to rotate the column at its fixed ends due to eccentric or induced moments. This is relatively small and is neglected in this analysis since the assumption of a rigid frame has not been introduced.

It is cautioned that the results secured by the above analyses are only approximate but give practical determinations of the magnitude of lateral restraint required to fix points of support and unsupported length of compression members. These potential lateral forces must be provided for and can only be resisted by bracing of proper stiffness and size, with connections to the main members that eliminate slippage in the joint. Knowing the forces, the stresses and moments in the braces can be computed, and the connections can be designed for whatever eccentricity exists. In most structures other considerations enter into the design of bracing, which frequently is required to support a part of the superimposed floor loads or to resist wind stress in addition to the potential lateral forces computed by the above equations. In the light-steel framing of building structures, particularly of the wood-joisted, wall-bearing type, consideration is generally limited to vertical forces and the application of these methods will insure sufficient stability, and will make such structures safe without resort to the principles and methods of the rigid frame.

GEO. E. STREHAN,
Consulting Engineer, New York, N. Y.

Good Advice on Building Codes

Sir: Your editorial "Extravagant Building Codes" (*ENR*, Aug. 14, 1941, p. 210) issue repeats charges that have been made many times, but does not go to the root of the matter. Codes which attempt to be either nation- or state-wide take so much time to prepare and meet with so much opposition that acceptance is unlikely; and they are apt to be out of date if and when they are accepted. The best that can be hoped for is to get as large a region as possible covered by a basic code, containing controlling provisions only, passed by legislative bodies.

Legislators are not in continuous session, do not have the required experience and should not spend their time on details of building codes. In spite of the general objection of legislators and lawyers to the delegation of legislative powers to appointed boards, details of codes, and especially amendments which will allow new materials and methods to be used promptly, should be determined by boards appointed by governor or mayor, and chosen to represent the best technical experience on the subject. The majority of such a board should be composed of architects and engineers with a minority representation of real estate men and general contractors, but with no representatives at all of subcontractors, labor, material men or lawyers. The decisions of such a board should be subject only to approval by the governor or mayor. Such boards should preferably have state-wide authority, except possibly in the case of the larger cities, because a small city or town is not likely to have a competent resident personnel. It is also unfair to both producers and consumers of new materials to compel proof of the value of improvements to individual building departments, many of which are manned by men with limited experience. If constitutions do not allow such a common-sense treatment of the ever-changing problems of the great industry of building then the constitutions should be changed.

Another fundamental difficulty in drafting building codes is the legal objection to the inclusion of provisions by reference to standards of technical societies. Although many codes include such references it is clear that in some jurisdictions at least they can be and have been invalidated by court action. The "Plumbing Manual," Report BMS 66 of the National Bureau of Standards, is an example of a code which includes provisions by reference to some twenty-five standards. This makes it useless in states where the Attorney-General rules that such references are illegal. Not only should provisions by reference to standards be encouraged but codes should be allowed to follow revisions of standards automatically to keep them up to date.

Copyrighting of building codes should be discouraged. No code can possibly be the original creation of any group.

The National Bureau of Standards should be encouraged to publish all of the information which it gathers, not only to government building agencies, but to the whole construction industry. The bureau should publish the results of tests of private presentations rather than, as at present, keeping names of products a secret. If producers are not willing to have the results made public the bureau should refuse to make private tests. It would be interesting to know the comparative governmental expenditures for research and publications for agriculture and for construction.

CHARLES W. KILLAM
Professor of Architecture, Emeritus
Harvard University

EDITORIALS

VOLUME 127 NUMBER 9

August 28, 1941

Factories for the Future

A LOOK AROUND at the tremendous crop of new factories generated by defense gives a preview of our peacetime industrial skyline of the future. These buildings are too good to be boarded up after the emergency is over, and if there was ever any thought that they were merely temporary it must by now be dispelled. The modern factory has often been likened to a machine, and the comparison is particularly appropriate as regards scrapping the old after it has become obsolete. Many machines are kept in service after their economic efficiency is far below par, and factories likewise. But the practice is one to be avoided, and the government-owned defense factories if bought by private interests after the war will be a boon to industrial America. The new defense factories were designed and built quickly under great pressure, but they have everything that old factories lack. One has only to read the series of articles running in this journal on "Factories for Defense" to appreciate the truth of such a statement. And once such industrial plants are the rule rather than the exception, scrapping of old inefficient buildings will go forward more rapidly than ever. Factories for defense are factories for the future.

For the Good of All

DESPITE its praiseworthy achievement in building camps for over a million soldiers on a schedule never before equalled, the construction industry is in the doghouse so far as Congress is concerned because the costs greatly exceeded the preliminary estimates. The fact that the War Department concedes that its early estimates were bad in many cases merely divides but does not shift the blame that Congress attaches to the cantonment construction procedure. The situation places a responsibility on engineers and contractors that their individual acts do not provide ammunition for those who would picture the whole profession as profiteers. For example, we recently had occasion to criticize the War Department for requiring that contractors and engineers who had fee contracts on the previous cantonment program waive any claims for extra compensation before they would be considered for new contracts. Although the ruling seems to set a dangerous precedent it may well be that it should not be challenged too widely if by so doing Congress is given more ammunition with which to attack the construction industry. Under new and able direction the Quartermaster Corps is missing no opportunity to place its construction on the highest possible plane of efficiency, where it can elicit nothing but praise. In the same spirit engineers and contractors might well consider writing off any losses they may have sustained in the first construction program. In this way and in others, individual acts can aid the profession at large.

Scrap for Defense

ENGINEERS HAVE A STAKE in the movement begun on Aug. 15 by Ralph Budd, transportation commissioner of the OPM, to develop latent sources of scrap iron and steel. All can improve the chances for getting the new steel that they will need for their future operations by helping to locate and collect the thousands of tons of scrap metal scattered over the whole country. First move is on unused street-car rails, but many other sources of scrap are available: old water pipe lying in storage yards, old valves and castings, abandoned machinery, worn-out street maintenance equipment, tools and manhole covers. Systematic cleanups will reveal a vast amount of old iron and steel, and by some skillful local publicity, like the recent campaign to collect old aluminum, householders could be persuaded to add materially to the scrap pile. Scrap is so essential that its collection represents a defense contribution of first order. And unless defense needs can be met, civil needs must go unfilled.

First Cost Divided by Fifty

PUBLIC RECOGNITION was recently accorded the service record of a pioneer development in civil engineering when the citizens of Bellefontaine, Ohio, staged a community celebration noting the fiftieth anniversary of the first portland cement concrete paving laid in this country. Considered a costly public improvement in 1891, today, after a half century of continuous service, this pavement is still carrying modern traffic. Pertinent comments could range from "pointing with pride" to the subsequent progress which has been made in paving technique, to "viewing with alarm" the prob-

lems still remaining to be solved in this field after fifty years of study and experiment. However, if service records provide the basic data for engineering economics, then the most significant comment would be concerned with the element of cost. Bellefontaine has probably got its money's worth from a job that was no doubt attacked as an unnecessary waste of public funds. Perhaps many of our present-day public works that now are looked upon as extravagant may chalk up a service record that will deny the charge. It is the engineer's responsibility to see that they do.

Silzcnam

THE ABOVE TITLE is not the name of a city in eastern Europe but the initials of vital defense metals arranged in the order in which OPM has asked the Army and Navy to specify them when the product under design permits it. Expanded, the word spells steel, iron, lead, zinc, copper, nickel, aluminum and magnesium, and is used here merely as an excuse, if one is needed, to emphasize the importance of aluminum and to praise the Aluminum Company of America for its outstanding contributions to the national defense.

Similar praise might go to the Dow Chemical Company for increasing the supply of magnesium, but Alcoa incites first admiration because its accomplishments have been made in the face of one of the worst political kicking-arounds in history. No matter what one may think of the Aluminum Company's alleged monopolistic character, there is basis for nothing but praise in its $200,000,000 expansion program, (using its own money), and for its unstinted cooperation with OPM and the federal departments, the latest example being the agreement with TVA on power, which involved giving up the best damsite in the southeast, title to which Alcoa had held for a quarter century.

We need the capacity to produce 1,600,000,000 pounds of aluminum by 1943, more than the whole world produced last year. In 1939, U. S. production was 327,000,000 pounds, and by July, 1942, it will reach 825,000,000 pounds, to which Alcoa's contribution will be 760,000,00. So, while aluminum is near the top of the list of critical materials, the Aluminum Company is just as highly placed in a list of organizations that are contributing to the national defense.

Designing Against Bombs

BIT BY BIT evidence that trickles through from Europe on bombing damage to buildings serves to orient the thinking of American engineers regarding a new responsibility that modern warfare has deposited on their doorsteps. The authoritative article in the Aug. 14 issue by Otto Bondy, competent British structural engineer, augmented the available evidence in important degree. And in this issue in the first of two articles, Professors Wessman and Rose of New York University, who have been conducting a special course for practicing engineers on bomb-resistant design, analyze this evidence for its meaning and usefulness to American structural engineers. It is a subject that can no longer be considered academic.

Up to now the evidence justifies at least two fairly definite statements. Although bombs generate economically irresistible forces in the near vicinity of the explosion, damage can be reduced and localized by proper design, just as it has been in the case of earthquake, hurricane and tornado forces. And a second fact that now is plain is that fire quite as much as bomb blast is a threat that an air raid carries.

As more facts such as these are accumulated, it should be possible to formulate a philosophy of design respecting air raid protection. So far there is no crystallization of opinion on what forces it is worthwhile to try to resist, or whether or where existing design knowledge is lacking, or even whether bombing offers any threat to American cities; although doubts on the latter point should be weighed very carefully in view of the probability that the present war is not the only one that a building with a 50-year life may have to go through.

Some progress toward such a philosophy is, however, being made. New York University's course in bomb-resistant design for practicing engineers is perhaps the best example. But this course is merely an example of an activity that should be nationwide among engineers. The principles of bomb-resistant design must be developed as quickly as possible, and the first step is to decide on an acceptable philosophy or design objective. This is a job for the whole profession, the distance of a given community from the continents of Europe, Africa or Asia having no bearing on the matter.

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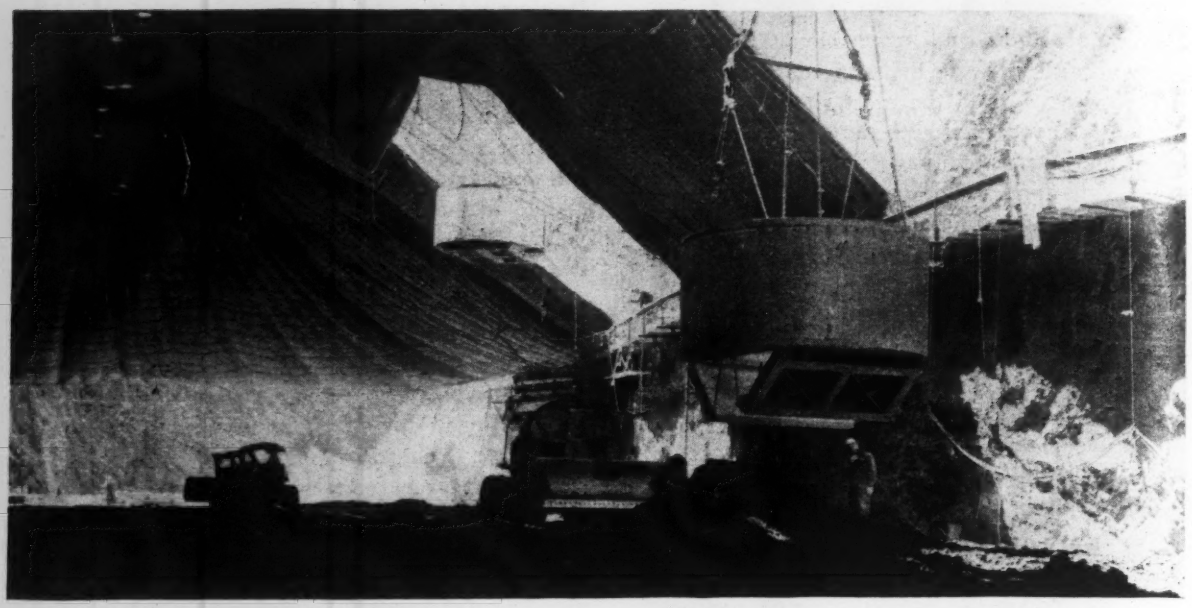


Fig. 1. Under the "big-top" a 10-cu. yd. bucket has just dumped its load of core material.

Dam Building Under Canvas

***Contents in Brief**—Earth and rock fill for the 425-ft.-high Mud Mountain Dam in Washington was placed under a canvas tent stretched between the canyon walls, as one of several measures used to control moisture in the material. With one-fourth the core material rolled in place and 40 percent of the dumped rock delivered, the canvas tent, which is reported as having "paid for itself," was removed. With additional material going in at the rate of 12,000 cu. yd. per day, completion of the 2,230,000-cu. yd. fill is expected by the end of the year.*

THE RECORD-HEIGHT earth-and-rock-fill embankment known as Mud Mountain Dam, which the U. S. Engineer Department is building on the White River about 47 miles southeast of Seattle, Wash., is progressing rapidly, and completion is expected by the end of the year. As of the first of July about 1/4 the rolled earth core was in place (108,000 out of 412,000 cu.yd.) as well as about 40 percent of the coarse dumped rock, which constitutes the up and downstream shells supporting the core. The "big top" or canvas covering suspended over the central core zone had just about completed its function and was scheduled for removal "on the first dry day" after July 10.

It was decided to remove the tent when it had served two of the three successive locations for which the supports were designed. The fill was placed until it was about 14 ft. below the canvas in its second position and trucks could no longer pass under the eaves. Raising the tent to the third level was not thought necessary in view of the fact that much of the remainder of the job will be carried on in the dry season. In case of heavy rains, it is planned to spread tarpaulins over the core. With this in mind, the core will be graded with high centerline and a slope up and downstream sufficient to provide drainage. Data on the tent were published in *ENR*, March 27, 1941, p. 452.

The average rate of progress is now about 12,000 cu. yd. per day (three shifts), and the average distribution of this material is 1,600 cu. yd. in the core, 700 cu. yd. in the transition zone and 9,700 cu. yd. in the outer rock shells. The schedule has been to arrange the 18 shifts in each week's work so that for 10 shifts the dump trucks deliver to the downstream shell and core while the remaining 8 shifts are devoted exclusively to the upstream shell. This arrangement was necessary because in the early stages of work the canyon was so narrow (less than 100 ft.) that there was not room for equipment to work on the rolled fill core while dump trucks were crossing the core to reach the upstream shell. An additional reason lies in the fact that only 40 percent of total rockfill is in the upstream level while 60 percent is downstream in zone 3.

Endeavor is being made to arrange the work so that the core will be built up as far as practicable ahead of the supporting rock shells, since in the latter part of the job the core will be the limiting factor in progress and any extra advancement that can be made on the core in early stages will speed the completion date. As the dam height increases the length becomes greater (crest length 700 ft.), and in the higher levels rolling operations can be confined to one half the length, leaving the other half for trucks hauling the upstream rock.

Material for the coarse rock fill is brought in by dump trucks with bodies ranging up to 20-cu. yd. capacity and with gross loads as high as 55 tons. The rock is trucked in from a quarry 4 miles away over a road built expressly for the purpose. That portion of the road in the canyon near the dam presented a problem because of the steep canyon slopes and the great differences in level between destination at the start and at the finish of fill placement operations. In some parts of the canyon the road had to traverse such loose ground that it was feared excavation would cause slides. Over such places trestles were built, totaling about ¼ mile in length. Trestles were also necessary in the steep-walled rock gorge near the dam.

All of the trestles, totaling about 1.0 mile in length, were decked with a double layer of 4x12-in. planking, thus giving 8 in. of timber for carrying the truck loads. This deck was paved with 3 in. of concrete reinforced with No. 10 wire mesh. To bond the concrete surfacing and the plank deck, ⅜x3½-in. railroad spikes were driven into the deck before the concrete surfacing was poured, allowing them to project an inch or more into the concrete. At the start of trucking operations, grades as steep as 12 percent were used to get the loaded trucks down into the canyon bottom. Later, as the trucks had to reach higher elevations, upgrades of as much as 12 percent were used. The upper portions of the dam, in which the yardage will be relatively low, will be placed by trucks coming in over the crest.

Material for the core is hauled in a train of 5 dump cars pulled by an 80-ton locomotive from a borrowpit about 1.7 miles away, to a wet storage pile, later being transferred by conveyor belt to a bunker over the oil-burning dryers, in which moisture in the core material is decreased to the desired amount. The dryers are located near the spillway whence a belt conveyor delivers to wood-stave silos on the edge of the canyon. The silos discharge into two 10-cu. yd. buckets each delivered by derrick to a location in the core whence bulldozers can spread the impervious core material for rolling.

Core material is scalped of plus 5-in. material in the pit and at the dryers passes through a 3-in. screen (the plus 3-in. material goes back into the

Fig. 2. Canyon rim facilities at Mud Mountain Dam: covered conveyor belt brings material from storage piles to dryer plants and thence to silos in foreground from which two derricks lower it into the canyon below. Shop buildings and main camp are seen in the background.

Fig. 3. Tent suspended over the core zone. Derricks are lowering 10-cu. yd. buckets (one of which can be seen in left center) through the hatches in the tent. Note walkways (which are also drainage gutters) on the canyon wall for successive tent positions.

flow of core material just beyond the dryers). Thus only minus 3-in. sizes go through the dryers, which are slow-moving rotary kilns set at an inclination such that the material progresses downward from the upper end by gravity to discharge at the lower end. The draft through the kilns, from fire box to stacks, heats the core material sufficiently to drive off the necessary percentage of moisture. Oil feed and kiln speed can be regulated to compensate for varying moisture content in the incoming material, which ranges from 20 to 21 percent up to a maximum of about 23 percent immediately after heavy rains. This moisture content is reduced so that material leaves the dryers with 17½ or 18 percent of moisture, a decrease of 2½ to 5 percent according to conditions. The optimum moisture content for rolling into the core is about 1 percent less than that at which the material leaves the heaters, to allow for the 1 percent of the moisture lost in steam between dryers and core.

Moisture extraction is accomplished by a relatively rapid process by using three drying units in parallel to provide the required capacity of some 2,300 cu. yd. per 24 hr. Remaining in the dryers only a few minutes, the material is discharged at a temperature of about 120 deg. F.

Careful records have been kept so that on completion of the job it will be possible to rate the fuel requirements in quantity of oil per cubic yard for each percent of moisture removed from the core material in the drying operation. In the early stages of the operation reported in this article, the rough average suggested that the fuel requirement was about ½ gal. per cu. yd. for each percent of moisture removed.

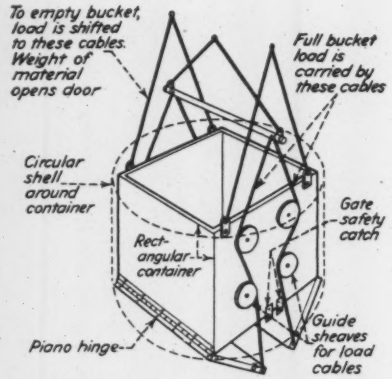

To empty bucket, load is shifted to these cables. Weight of material opens door
Full bucket load is carried by these cables
Circular shell around container
Gate safety catch
Rectangular container
Piano hinge
Guide sheaves for load cables

Fig. 5. Details of 10-cu. yd. bucket and its gate operating mechanisms.

The belt operates under cover and the silos into which it delivers are likewise covered. The silos discharge into 10-cu. yd. buckets, one for each silo, permanently attached to the tackle of the derrick that moves it. These buckets, designed for this express function, consist of a rectangular central section protected by a circular shell of ⅛-in. sheet steel.

Buckets are lowered through 20x 30-ft. "hatchways" in the tent. These hatchways are equipped with canvas covers so that the openings can be closed to keep out the rain when the work is shut down. However, heavy rains did not cause shutdowns because rain falling through open hatchways on material just deposited did not add enough moisture before spreading took place to make any material difference.

The side walls of the canyon as cleaned off in the original excavation were trimmed in final scaling to a slope of 1:20. The idea was that caves under overhanging projections on the wall surface could not be filled effectively by the methods used in the placing of core material and hence might cause voids should settlement of the fill occur. Where it was impracticable to carry the 1:20 scaling operations back far enough to clear out all such caves, (some of them extended as much as 30 ft. back into the canyon walls), forms were constructed and anchored to eyebolts grouted into holes driven into the rock. These caves were filled with concrete when the level of the core top gave convenient access for placing forms and concrete.

Material dumped on the core is spread by bulldozers and then compacted by not less than 6 passes of a sheepsfoot tamper. In addition to the large tamper, drawn by tractor, a small tractor with a pair of petrolithic tamper drums for rear wheels is used close to the canyon walls where maneuverability is essential. In the narrow strip immediately adjoining the rock, where even the small tractor cannot work, power-driven hand tampers are used to compact the material.

In dumping rock on the up and downstream sides of the core, water jets are used continuously to sluice the fine materials into the voids, thus giving a rock-on-rock bearing and reducing eventual settlement. For this work, water jets are placed in convenient positions, sometimes on the access trestle (for the downstream toe) and frequently on the slope below, whence the jets can be directed upward against the material.

The work is being done by contract for the U. S. Engineer Department whose personnel was listed in an article on design of the dam published in *Engineering News-Record*, Mar. 13, 1941, p. 80. That article also lists the personnel of the contractor, the Guy F. Atkinson Co. Since that time A. H. Rodes has succeeded W. E. Hoy as resident engineer for the U. S. Engineer Department and his assistant is R. F. Bracelin. J. J. Standish has succeeded D. E. Root as general superintendent for the contractor.

Fig. 4. Jetting on the upstream toe in the early stages. The tent is in process of being raised to position. The jets operate under pressures of 60 to 70 lb.

Piping Oil from Maine to Montreal

***Contents in Brief**—First of the new oil pipelines to be built under the impetus of national defense needs, the 236-mile Portland-Montreal line is unique to the New England area. Costing $8,500,000, along with pier, storage tanks and 8 pumping stations, this project is employing 1,700 men to complete the job in three months.*

Pipeline passes through rugged country. Eight pumping plants lift the oil 1,950 ft. above sea level.

ACROSS THE ROCKBOUND STATE of Maine and through the granite hills of New Hampshire and Vermont, 1,700 sweating men are snaking a steel pipeline to carry crude oil from Portland to Montreal, Canada. Speed is the slogan on this $8,500,000 national defense project, which is being financed and engineered by the Standard Oil Co. of New Jersey to eliminate a 12-day haul and thus minimize the present shortage of oil on the Atlantic seaboard. Work is being pushed on a 7-day-a-week schedule to complete the 236-mile line in 120 days.

Construction of this first crude oil pipeline in the New England states is bringing special problems to the experienced pipeline men from Iraq, Rumania, Venezuela, Texas, Louisiana and Kansas who have been assembled to complete the line in record time. The obstacles to speed are transportation difficulties in the rough and roadless terrain, and extreme variations in trench excavation, which ranges from tough granite to marshy swamps. About $300,000 of new construction equipment, including tractors, trucks, backhoes, trenching machines, compressors and welding generators, was purchased for this project by the two contractors, Williams Bros. Corp., of Tulsa, Okla. and Oklahoma Contracting Co., of Dallas, Tex.

Components of the project

The Portland-Montreal pipeline is the first of the new oil lines to be built under the impetus of national defense needs. Because of its international character, appropriately recognized on Aug. 1 with formal ceremonies when sections were welded on the border, two companies were organized by the Standard Oil Co. of New Jersey to carry on the work.

In the United States the Portland Pipe Line Co. is directing operations, while the Canadian portion of the line—some 65 of the 236-mile total—is being built by the Montreal Pipe Line Co. The oil industry refers to this installation as the Esso pipeline.

Portland was selected as the eastern terminus of the line because the harbor here is one of the best on the Maine coast. Comparatively little difficulty is experienced with fog, ice and tide conditions, and a 35-ft. channel makes it possible for the larger size tankers (150,000 bbl., equivalent to 6,300,000-gal. capacity) to enter port at all times. The oil reaching the Montreal refineries has its origin in Colombia and Venezuela.

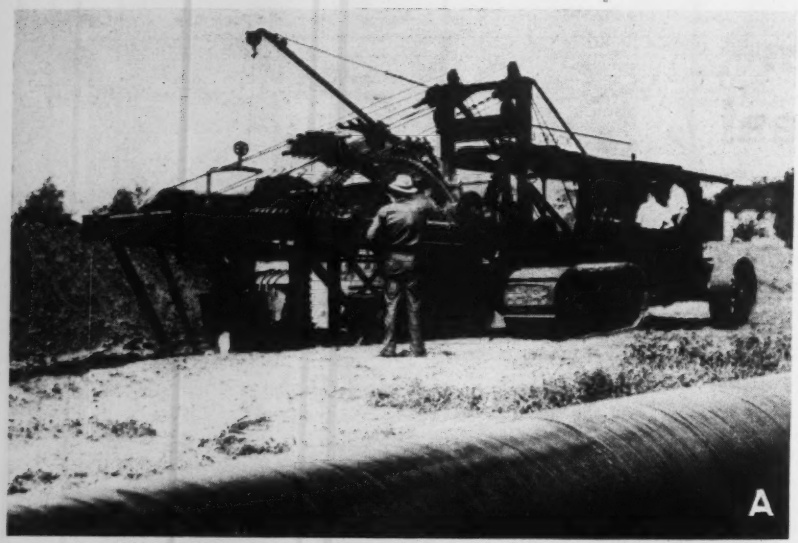
Route of the pipeline from Portland to Montreal. Circled points on the line indicate pumping stations, which are spaced at about 30-mile intervals.

To facilitate quick discharge of tanker cargoes a 920-ft. finger pier is being built at South Portland to accommodate two boats at one time. Six storage tanks of the floating roof type, each with a capacity of 140,000 bbl., will receive the oil at the Portland terminus. Two of these tanks are adjacent to the pier and the others are located 3 miles inland at a 34-acre tank farm. Contract for the fabrication of the tanks, which are 144 ft. in dia. and 48 ft. high, is held by the Chicago Bridge & Iron Co.

The 12-in. inside diameter welded steel pipelines will carry 50,000 to 60,000 bbl. of oil a day, flowing at the rate of 3 mph. To assure prompt movement of the oil, which must be lifted some 1,950 ft. above sea level, eight pumping stations will be used. These stations are spaced at about 30-mile intervals, and each station includes two triplex, reciprocating pump units as well as a 30,000-bbl. surge tank. Electric power will be employed at six of the stations and diesel engines are to be used at the other two. Provisions are made so that stations can be bypassed if a power failure occurs; this will curtail but not interrupt the flow of oil.

Operations on all fronts

Construction is being pushed vigorously on all fronts to complete the work by Oct. 31. At the South Portland terminus activity was started at the end of July on the pier, pipe and tank installations. Working in opposite directions from Gorham, N. H., pipe-laying operations were begun on June 28 and are proceeding at an average of 3,000 ft. per day. At Highwater on the Vermont-Quebec border, about 5 miles of pipe has



Steps in pipeline laying: (A) Wheel-type trench diggers that are used where ground is free of rocks; the trench is 3 to 4 ft. deep and about 3 ft. wide. (B) Pipe is strung along the 35-ft. right-of-way with the aid of trailer trucks. (C) An alignment clamp holds the ends of pipe in contact so that a welder can make the initial "stringer" bead.

been laid and a formal ceremony on Aug. 1 signalized the welding of the border crossing. Near Montreal work is underway on the St. Lawrence River crossing, which will be laid at a depth of 16 ft.

The line will require almost 33,000 tons of steel pipe, most of which is being fabricated by the Youngstown Sheet & Tube Co. along with the Spang-Chalfant Co. The pipe comes in 40-ft. random lengths with an outside diameter of $12\frac{3}{4}$ in.; the wall thickness is $\frac{3}{8}$ in. and each foot of pipe weighs 49.56 lb. Each end of the pipe is beveled to permit butt-welding. No protective enamel or coating is used except a light primer coat, since there is no evidence in this area that soil or other conditions will lead to corrosion trouble.

At the South Portland terminal where some 3 miles of 24-in. interconnecting pipe is being laid, a 1-in. hot asphalt and felt-wrapped coating is applied in the field because here the soil is corrosive from salt-water impregnation.

Construction procedure

Based on a tentative route laid out with the aid of U. S. Geological Survey maps of the region an aerial survey was made from a plane flying at 17,000 ft. From photographs taken on this flight, a mosaic strip map covering a 2-mile width was made of the desired route.

Field surveyors then staked out the route on the ground, making minor changes as required.

Right-of-way men, working with local real estate men, then obtained the necessary easements covering a width of about 35 ft.; once the line is in place the land over it may be cultivated.

Consecutive steps in the construction of the Esso pipeline are as follows:

After the right-of-way is obtained a gang of workmen clear a path. Woodmen fell the large trees, following which bulldozers clear out underbrush and level off a space about 35 ft. wide.

The next gang excavates the trench in which the pipe will be laid. In soil that is free of roots and rocks trench-digging machines are used. Where rock ledge is encountered the trench is blasted out following which a backhoe ($\frac{3}{8}$ to $\frac{3}{4}$-cu.yd. size) excavates to the required depth. The ditch itself is usually 3 ft. wide and varies in depth from 3 to 4 ft.

While excavation is under way the pipe is strung along the right-of-way with the aid of trailer-trucks. Because of the difficulty in maneuvering a 50-ft.-long trailer on the narrow access road it is customary to have a second power unit back up behind the loaded trailer. After all of the pipe has been taken off, the front power unit is detached and the backed-up unit then is ready to pull out the trailer. Thus, without any loss of time, the trailer is on its way for another load of pipe while the front power unit slowly backs out.

The next step calls for the pipe to be lifted by "boom-cats" (crawler tractors equipped with a side boom and power hoist) so that it can be laid on wooden supports, which are spaced on top of the trench at 20-ft. intervals. Laid on top of the trench in this way, the adjacent sections of pipe can be brought together easily for welding. An alignment clamp holds the ends of the pipe in juxtaposition so that a welder can put a "stringer" or initial bead around the pipe. The alignment clamp is then taken off and the gang moves ahead to add another section of pipe. Meantime another welding gang steps into place and occupies itself with the job of filling the butt joints. The joint is filled by a weld of four passes.

After the welds are completed the pipe is lowered into the ditch. Since no attempt is made to excavate the trench to a constant straight grade it becomes necessary to bend the pipe in order to accommodate it to changes in topography. The bending operation is a tailor-made job accomplished with the aid of two boom-cats. One of the cats either rides on the top of the pipe or holds it down with a winch at the point where the bend is to be made, while the other goes ahead some 20 to 30 ft. and, with the aid of the boom and cable, pulls the pipe to the required curvature, either horizontal or vertical.

At the end of each day's pipe laying a cap is welded to the end of the last pipe and air pressure up to 120 lb. per sq.in. is applied. Before the air is turned on, however, a scraper fitted with a rubber disc is inserted in the pipe at the beginning of the test section; this is pushed through the line by the air and effectively cleans out debris which later might obstruct the flow of oil. Each joint then is covered with a soap solution so that air bubbles will be formed and detected if there should be any leakage. After successful completion of this test the line is backfilled and the site cleaned.

When the pipe laying is completed and the pumping stations are in operation, the line will be filled with water and the internal pressure built up to 800 lb. per sq.in. This hydrostatic test is made to insure proper functioning of the line at its normal operating pressure of 720 lb. per sq.in.

As soon as the line starts carrying oil a daily airplane inspection will be inaugurated. An observer in the air can easily note dark stains on the ground which would indicate oil leakage from the pipeline. Use of an airplane patrol eliminates the need for pipe walkers.

Butt joints are filled with a weld of four passes; only the most expert operators can perform upside-down welding as is required on this work.

Bending pipe to fit the trench profile. The rear "boom cat" holds down the pipe with an underslung cable, while the forward tractor puts a strain on its cable until the pipe is bent.

Who's who on the job

All engineering and construction operations are under the direction of H. M. Stevenson, chief engineer of the Portland Pipe Line Co. George Lee is assistant chief engineer, and A. H. Chapman is project engineer at the Portland terminal.

David Williams, vice-president of Williams Bros. Corp., which holds the contract for the construction of the eight pumping stations and all pipe work west of Gorham, N. H., is supervising operations for his company, assisted by H. R. Davis, general superintendent.

T. A. Hester, president of the Oklahoma Contracting Co., is directing work on the contract held by his company for all pipe work east of Gorham, N. H., and at the South Portland terminal.

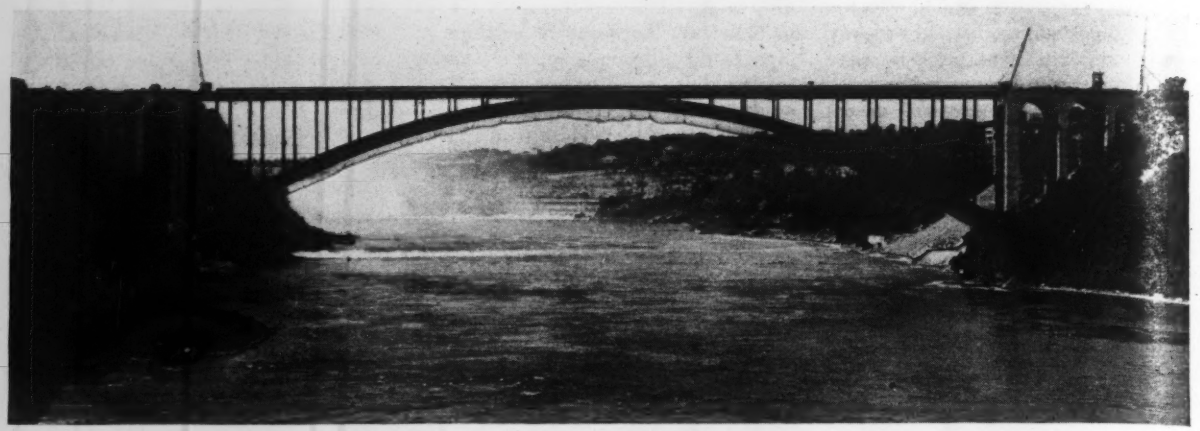


Fig. 1. Framing the Falls, new bridge over Niagara gorge provides a modern international highway link.

Cables Carry Niagara Arch to Closure

***Contents in Brief**—The largest hingeless arch span in the world, 950 ft., is being built to replace the bridge over the gorge just below Niagara Falls that was carried out by ice three years ago. Falsework being impossible, the plate girder ribs were supported during erection by an elaborate cable system. Rocker bents on the abutments provided a common point of attachment for forward and backstay cables. Cable stresses were measured by dynamometer. Rib traveler erected pieces weighing as much as 75 tons. Closure section fabricated to fit and installed by jacking.*

RAINBOW BRIDGE, the 950-ft. span hingeless steel rib arch under construction at Niagara Falls, N. Y., to replace the 40-year-old Falls View spandrel arch that was carried out by an ice jam in 1938, is a spectacular bridge in a spectacular setting. And topping its spectacular aspects is the method of erection used to bring to closure the two halves of the arch ribs built out from the American and Canadian sides of the Niagara River gorge a half mile below the famous Falls. Because water depths of more than 160 ft. precluded the use of falsework, resort was had to elaborate cable tieback systems, whose installation and operation were intricate, costly and exacting. Because of the inherent demands of a fixed arch for accurately predetermined moments and thrusts, closure operations at the crown required heavy and accurate jacking and aligning apparatus. And because of the necessity for handling rib erection pieces averaging 55 tons apiece (75 tons maximum) derricks and auxiliary equipment were unusually large and sturdy. Few bridge jobs in recent years have been as out-of-the-ordinary as this one.

There have been eleven bridges built across the Niagara Gorge since 1850. Of these one was a cantilever, four were arches and six were suspension bridges. Several of them set new span length records for their types and times, a precedent that is revived by the new Rainbow Bridge which is the longest fixed or hingeless arch in the world, its nearest competitor being the 800-ft.-span Henry Hudson arch in New York City.

As shown in Fig. 3, Rainbow Bridge consists of the main steel arch span and high concrete approaches on either end to connect it with the rims of the gorge, which are some 1,200 ft. apart. The arch abutments are placed 35 ft. above high water in the river, which is 28 ft. higher than those of its ill-fated predecessor, which were torn loose by the ice. Since the rise of the arch is 150 ft., the crown is approximately at gorge rim level.

Ribs are of closed-box type, 12 ft. deep back to back of angles and 3 ft. wide center to center of webs, with horizontal diaphragms inside and longitudinal stiffener angles outside, at quarter-depth points. Closed-box type plate-and-angle columns on the arch rib carry the deck, which provides a 10-ft. sidewalk on the Falls side and two 22-ft. roadways separated by a 4-ft. mall. The deck will be concrete.

Toll collection booths will be located on both sides as well as immigration and inspection facilities. On the Canadian side, because of the sloping terrain these facilities are accommodated on a spacious elevated structure of reinforced concrete, the space beneath being developed for an Ontario highway department garage and for stores along the street front that faces the gorge.

Foundations and approaches were completed last fall, and steel erection began about Christmas. Rather, assembly of the erection equipment began at that time, for it was not until Feb. 15 that the first grillage was set and not until Feb. 27 that the first rib section was erected. Then, although nearly two months had been required to get ready, 25 percent of the total tonnage in the arch was erected in a period of three weeks. From that time progress has been steady, and the arch was ready for the closing operations on May 19 when the last four main rib sections were erected leaving an 11-inch open-

ing at the center for the "keystone" pieces. While waiting for the closing key sections to be fabricated, the cable tieback system was taken down. Closure occurred on June 12, after which deck erection began and was completed July 10. The bridge is scheduled to be opened for traffic not later than Oct. 1.

Assembling the erection plant

Since erection operations on the two sides of the river were identical, this account is confined to the work on the American side. Initial objective was to get the erection plant assembled, particularly the tieback cable system, which consisted of a rocker cable bent set up at the forward end of the concrete approach viaduct; backstay tie strands leading from the top of the bent to concrete anchor blocks 350 ft. back from the rim of the gorge; and forward tie strands leading from the top of the bent to connections on the arch ribs. As a matter of general interest it may be noted that all of the Niagara tie strands had originally been used to support the footwalks used in constructing the cables of the Golden Gate Bridge at San Francisco.

The cable bent, 130 ft. high and 56 ft. 2 in. wide center to center of legs, the same as the width between arch ribs, was assembled from about 400 tons of the 3x3-ft. square columns and the floorbeams later used in the permanent structure to support the deck. Each vertical leg was composed of two column sections; the three cross-struts were each two floorbeams latticed together; and the inclined back-struts and the sill member were each a single column. The legs of the cable bent rested on pin bearings. Sixteen $1\frac{9}{16}$-in. dia. backstay strands (each of 150 tons ultimate strength) arranged in four layers were connected to the top of each cable bent column through pinned steel plate links, and at their lower ends were pinned and bolted to anchorage bars projecting from concrete blocks set into the rock. Each block weighed 650 tons, or one and one-half times the vertical component of the cable pull. Constructing these anchorage blocks was a relatively simple operation, although on the Canadian side the fissured nature of the rock made it necessary to test the anchorage pits by jacking a load in excess of the intended horizontal component into them before any concrete was poured. Finally, at each front top corner of the bent there were 20 pinned links for connecting the forward ties, which were attached to the rib sections in groups of 8 or 12 as rib erection progressed.

Fig. 2. Typical erection scene. Strands have just been attached at pt. 8 and are being removed from pt. 10.

First operation was to assemble an 85-ton stiffleg traveler derrick with

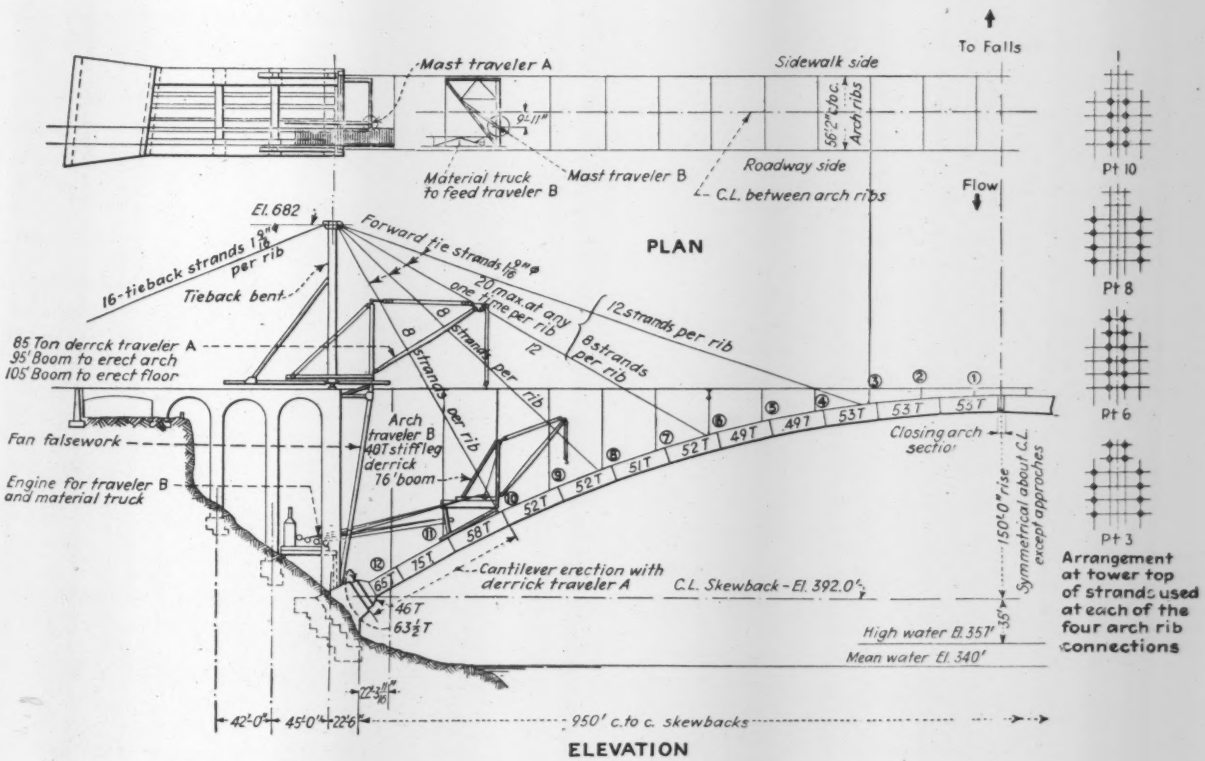


Fig. 3. Erection diagram for Niagara arch showing the cable support system and the disposition of hoist and derrick equipment. Small sketch at right illustrates cable arrangements as erection progressed from panel point 10 to panel point 3.

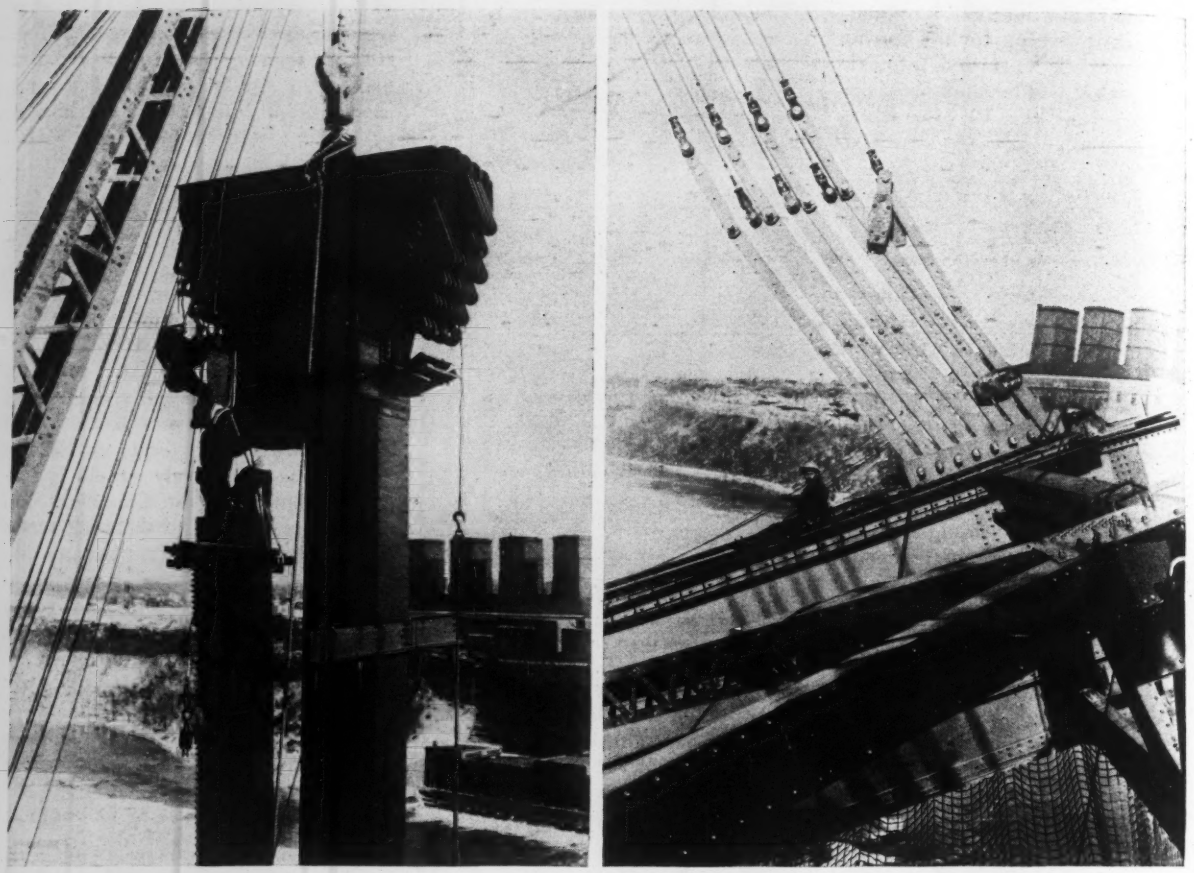


Fig. 4. Vital elements of the erection plant were the links by which strands were attached to rocker bent (left) and arch ribs (right). Left view shows the top section of the rocker bent being installed.

145-ft. boom at the back end of the approach. This derrick, traveler A, then moved forward laying a track for itself (of stringers from the permanent bridge deck) over the concrete approach structure until it was in position to erect the steel falsework, the first of which was the long, inclined "fan falsework" columns (Fig. 3) and the temporary steel deck about 25 ft. long beyond the end of the concrete. This was followed by erection of the cable bent and the hanging of the 32 backstay strands to the links at the top of the bent. The 145-ft. boom was then shortened to 95 ft. and the traveler moved through the bent out onto the end of the fan falsework. From its position at the end of this platform, traveler A could feed steel to a 40-ton erection traveler on the arch rib (traveler B), which it assembled after erecting the first three rib sections itself.

Adjusting the backstays

Erecting and adjusting the wire backstay strands between the cable bent and the anchorages was a time-consuming operation, since all strands in the same group had to carry as nearly equal loads as possible. First operation was to connect all backstay strands to the anchorages, using 3 in. of normal shims for each, which was calculated to produce about 5,000 lb. load in each strand, with the tower top leaned back about 3 ft. from the vertical and supported in this position by the sills and inclined struts. The elevation of one of the four strands of the lower layer was then determined at the quarter point nearest the anchorage by surveying for its true elevation. Reference to previously calculated strand adjustment charts, relating tower lean, temperature and elevation of the quarter-point, then showed whether the adjustment was correct. If it was not, shims were added or removed as required. All strands were, of course, shipped to the job cut and socketed to carefully calculated lengths. With one strand properly adjusted the other three strands in the same layer were brought to the same elevation. The procedure was repeated for each of the four layers of strands in each grouping.

While the backstay cables were being attached and adjusted, traveler A began erection of the arch rib sections, which were brought out to it over the approach on heavy truck and trailer equipment. First erection piece was the 63.5-ton grillage, followed by the 46-ton skewback, both husky members, the former having plan dimensions of 12x22 ft. and the latter being 5x22 ft. With these in place, traveler A successively lowered the first three rib sections which were cantilevered to panel point 10. Since the stress in the top anchor bolts had then reached 20,000 lb. per sq.in., this was the limit of cantilever erection, and the first set of forward tie strands was therefore attached and stressed until the anchor bolts were relieved.

The stage was then set for traveler A to assemble traveler B on the ribs. This traveler, operated from an engine on a platform behind the skew-

back, then took over the rib erection job, progressively moving forward. Steel lowered by traveler A was bolted to a special truck and pulled up a track on the arch to a point where traveler B could reach it by swinging around and behind. Under this procedure, and as the forward ties were moved from panel points 10 to 8 to 6 to 3, the arch ribs were brought to the closure stage.

One element of the rib erection that required special attention was the preparation of the abutments to receive the grillages, which in a fixed arch must be set to exact line and elevation. Each steel grillage and skewback section is held to the concrete skewback by thirty-two 3-in.-dia. anchor bolts, 32 ft. long, which the foundation contractor imbedded about 20 ft. in the concrete. These anchor bolts had to be accurately located, setting them to templets, so as to permit erection of the steel grillages to correct angle with the vertical, and also at right angles to the axis of the bridge, as well as at correct elevation. To attempt to finish this large surface to a true and accurately located plane was deemed impracticable if not impossible, and in lieu of this concrete pads 1 ft. square were placed at each of the four corners, whose surfaces could be dressed to correct plane to receive the 5-in. steel slab of the grillage. These pads were accurately surveyed before erecting the grillages. The remaining space beneath the slab was grouted full after the grillage was placed.

Handling forward cable ties

By far the most difficult and important part of the erection was the attaching and adjusting of the forward cable ties that supported the arch ribs until closure. Handling these tie strands was also the most costly single job in the erection sequence, accounting for one-eighth of the total operating expense.

As previously indicated the forward tie strands were of the same size as the backstays and likewise were attached to the top of the cable bent by pinned links. Connection to the arch ribs was also through pinned links but these were of an adjustable design permitting 30-in. lengthening or 24-in. shortening in 1-in. increments from a normal or mean setting. The links in turn were joined to the arch ribs by pinning them (with 4-in.-dia. pins) between the stems of two T-sections attached to the tops of the arch ribs by 1¼-in. high tension bolts.

Twenty link connections, corresponding to the maximum number of strands used per rib, were provided at each top corner of the cable bent, arranged in the pattern shown in Fig. 3. This diagram also shows the number and arrangement of strands for each of the four rib connections—panel points 10, 8, 6 and 3. The strand erection sequence was as follows:

(1) Eight strands were attached to the rib at pt. 10.

(2) When rib erection reached pt. 8, eight other strands were attached there and the eight at pt. 10 were disconnected and dropped back to the abutment to be lengthened for attachment at pt. 6.

(3) When rib erection reached pt. 6, these eight lengthened strands plus four more not previously used were attached there.

(4) Then with eight strands at pt. 8 and twelve strands at pt. 6, rib erection was advanced to pt. 3.

(5) Next four strands (one at a time) were taken from pt. 6, lengthened and re-attached at pt. 3.

(6) Finally the eight strands at pt. 8 were disconnected, lengthened, and re-attached at pt. 3. This gave twelve strands at pt. 3 and eight strands at

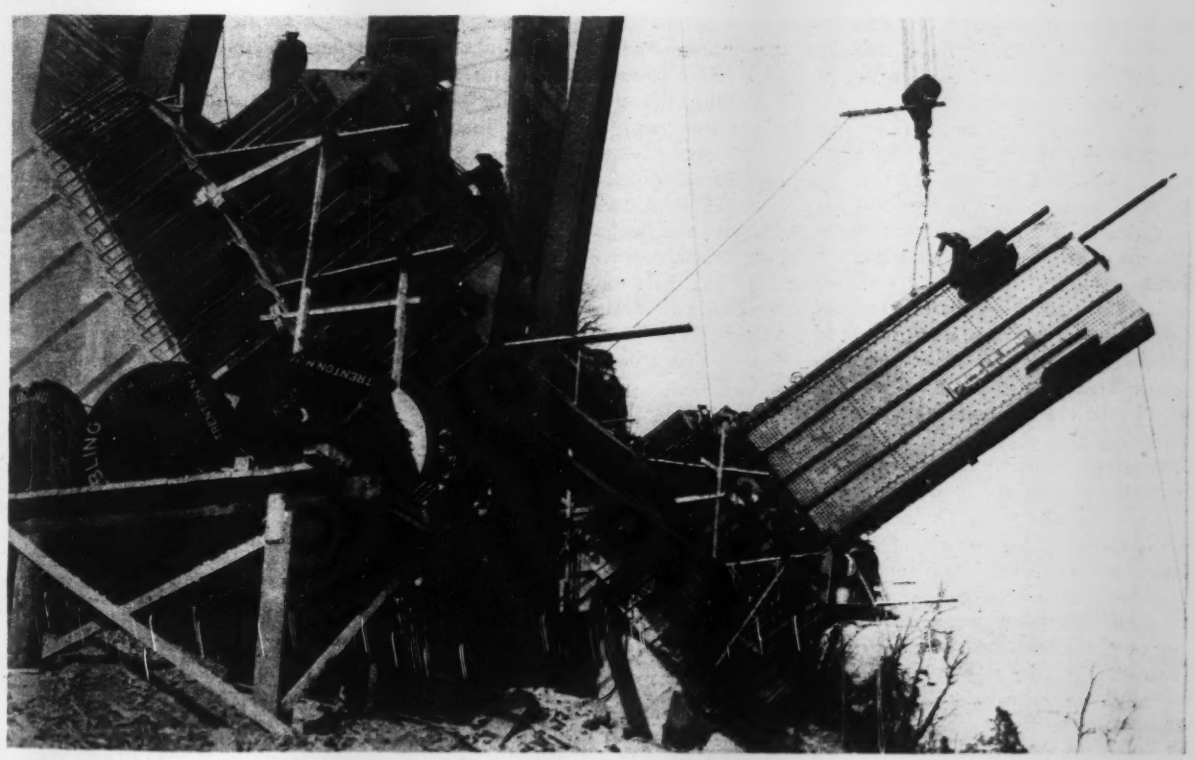


Fig. 5. Hingeless ends of ribs are composed of huge sections with maximum plan dimensions of 12x22 ft. Thirty-two 3-in.-dia. anchor bolts 32 ft. long connect the ribs to the concrete skewbacks.

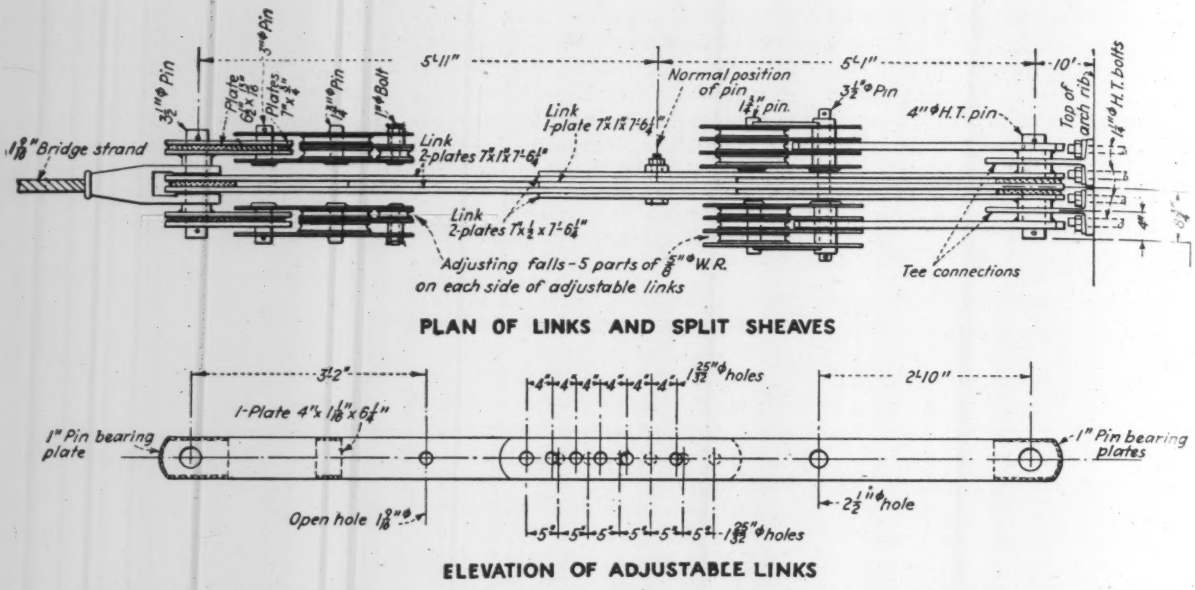


Fig. 6. Pulling tackle and adjustable links used to make connection of forward ties to the arch ribs. The rib connection detail consisted of two tee-sections with holes for 4-in.-dia. pins through their stems.

pt. 6, the arrangement that supported the rib to closure.

The maximum load per strand occurred under the condition in paragraph 6 above, when eight strands at pt. 6 and twelve at pt. 3 supported the rib. At that time each strand of pt. 3 carried a load of approximately 100,000 lb. The maximum load carried was about 1,600,000 lb. just before closure, when these twenty strands (eight at pt. 6 and twelve at pt. 3) were attached.

Transferring the strands from one point of rib attachment to the next was a slow and tedious process. Of the total time, most was required for adjusting the strands to proper length, but the actual transfer was also a time-consuming operation. As shown in Fig. 3 the successive strand layouts were designed to create a minimum of interference as one set of loose strands was pulled forward past a connected set, but the system could not be made perfect in this respect. Greatest difficulty arose in placing the strands at pt. 6, since they had to be taken out through those at pt. 8. The procedure is indicated in the sketch of Fig. 7 where a continuous haul line runs from one drum on the hoist back of the skewback, up over a jinniwink on top of the cable bent, down to the abutment, out to a snatch block at the rib connection and back to another drum on the hoist. A tie strand for panel pt. 6 was attached to this haul line near the abutment at pt. B. Then as the hoist pulled on both ends of the haul line simultaneously the portion of the line represented by ABC straightened out to AC, lifting the tie strand up and through the strands connected at pt. 8. This outhaul line first had to be dropped down through the proper opening but once this was done it could be connected to the next forward tie which could then be hauled up through those at panel pt. 8 and then pulled to a connection at panel pt. 6.

Pulling the tie strands to actual connection and adjusting them to length was effected by a special arrangement of falls pinned to the adjustable links, as detailed in Fig. 6. The sheaves in the falls were "split", that is half were on one side of the links and half on the other, so that the pull would not be eccentric. Each half of these falls carried a 5-part line so that a considerable pull could be applied. The lead line ran to the top of the cable bent over a block hung from the top link pin and down to the hoist.

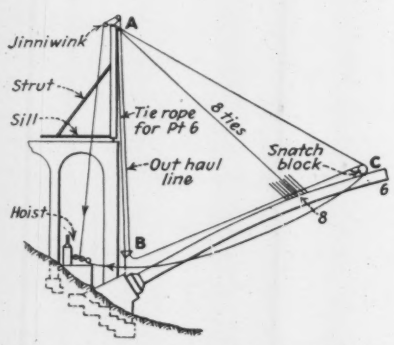


Fig. 7. Hoist line layout for pulling tie strands for pt. 6 through the eight strands attached to pt. 8.

The hole in the adjustable link to which the split falls were required to pull the tie strand was fixed by permissible stress in the strand and was determined either from stress measurements on the strand or from elevations at the end of the rib. In the early stages of erection the rib was stiff, and strand tension had to be accurately set at predetermined amounts; such tensions were measured by a special dynamometer clamped to the strand near the top of the cable bent. In the late stages of erection, however, when the rib was flexible, strand tension was relatively unimportant in determining rib stresses so long as the end of the rib was maintained at proper elevation; adjustments during this stage therefore were determined by rib elevation.

Closure operations

On May 19 the last arch rib section was erected, and only the crown or key section remained to be placed.

The apparatus required for closure, as detailed in Fig. 9, consisted of two 500-ton jacks installed above the top flange and two below the bottom flange of the rib, and an alignment guide hung below the bottom flange. As soon as this equipment was in place the two halves of the arch were jacked apart about 18 in. to take some

of the load off the tie strands; the ribs were then blocked top and bottom in this position and the jack loads released. The tie strands at panel points 6 and 3 were next disconnected as quickly as possible, in a predetermined order, so as not to overstress any of them and thus make them difficult to remove with the available pulling tackle. Also these strands were removed quickly so as to achieve as determinate a stress condition as possible before jacking and measuring the crown opening. All dead loads, including remaining erection equipment, were also carefully estimated at this time.

With all ties removed, and the effect of all other loads on the ribs carefully computed, the crown opening was measured. This work was done May 27, between midnight and 6 a.m. to avoid the effect of temperature changes as far as possible. The arch was placed in several previously calculated positions, and the resulting stresses carefully measured by means of 10-in.-dia. hydraulic test gages on the jack pumps and also by weighing capsules inserted between the jacks and the temporary jacking brackets. The agreement between the two was very close and was also within approximately one percent of the computed stress. It was therefore decided to use the theoretical crown opening of 11 in. in finishing the keystone pieces.

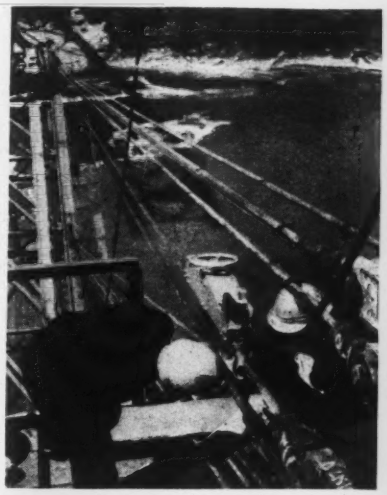


Fig. 8. Dynamometer being used to measure tension in the forward ties near the top of the cable bent.

While these were being finished in the shop, the remaining erection equipment was removed. The key sections arrived June 11 and were inserted the next day, followed by fitting up with both inside and outside the plates, removal of the jacks, brackets and other closure details.

The final operation of erecting deck columns, floorbeams and stringers was accomplished by the two traveler derricks, traveler B moving backward down the ribs and traveler A, re-equipped with a 105-ft. boom, moving forward over the deck. Traveler B erected the deck back to pt. 6, where it was dismantled by traveler A, which then completed the steel as it backed off to the abutment. Concrete placing began on Aug. 1.

Administration

Rainbow Bridge is being built and financed by the Niagara Falls Bridge Commission with revenue bonds. Consulting engineers are Waddell & Hardesty, New York, and Edward P. Lupfer Corp., Buffalo, who are co-engineers in the design and construction of the bridge. R. W. Cady of the Edward P. Lupfer Corp., is resident engineer in charge of construction. The bridge was fabricated and erected by the Bethlehem Steel Co. with E. L. Durkee as resident engineer in charge of field work on both sides. R. H. Smith is foreman on the American side and D. S. Shuman on the Canadian side. For Bethlehem, Jonathan Jones is chief engineer, D. S. Gendell, Jr., is general manager of erection, and G. A. Caffall is district erection manager. McLain Construction Co. built the American approach structure and Aiken & MacLachlan the Canadian approach structure. Canadian approaches are being built and financed by the Ontario highway department and American approaches by the N. Y. Frontier Park Commission.

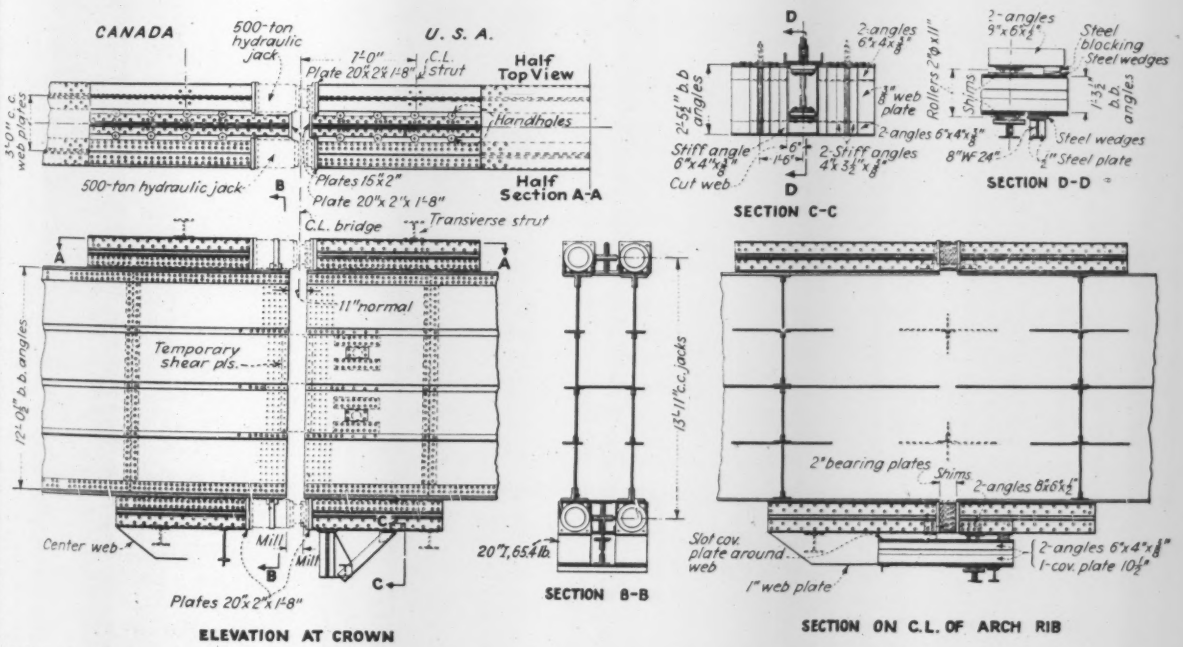


Fig. 9. Rib closure details at center of span involved jack reaction girders on both top and bottom chords and an alignment girder below the bottom chord on the center line of the rib. Four 500-ton jacks were used to effect closure.

Subsurface Explorations by City Forces

Irving V. A. Huie
Commissioner, Department of Public Works, New York City

***Contents in Brief**—Borings for subsurface exploration are generally made under contract but New York City's Department of Public Works has set up an exploration service that has operated successfully for over a year. The development of improved methods and tools, a simplified and uniform method of recording data, and a continuing policy of procuring and mapping subsurface information throughout the city are expected to yield paying results.*

THE DEPARTMENT OF PUBLIC WORKS of New York City, created under the new City Charter of 1938, has a large and continuing program of engineering construction. After a study of the existing methods of obtaining subsurface information this department concluded that the most immediate way of bringing order and method into subsurface investigations was to purchase equipment, hire the best available drillers and set up a section in charge of experts who could perform the required work in a proper and competent manner. If other municipal agencies wished to avail themselves of the services of this section, they might do so. If not, at least the work would result in establishing higher standards of making test borings, interpreting them and presenting the proper conclusions. Under this competition and stimulus, it was hoped that other agencies might improve their own practices.

Accordingly, during the past eighteen months, the department has placed in the field five city-owned and city-operated test boring rigs. With the cooperation of the Civil Service Commission, it has examined and appointed a staff of highly skilled drillers and helpers of long experience with local conditions. At the head of the organization is an engineering geologist familiar with the geological conditions in New York City and with the requirements of such exploration work. In charge of the operation of the rigs and the actual making of borings is a professional engineer with training in foundation work and experience in making, analyzing and reporting on boring work in this district.

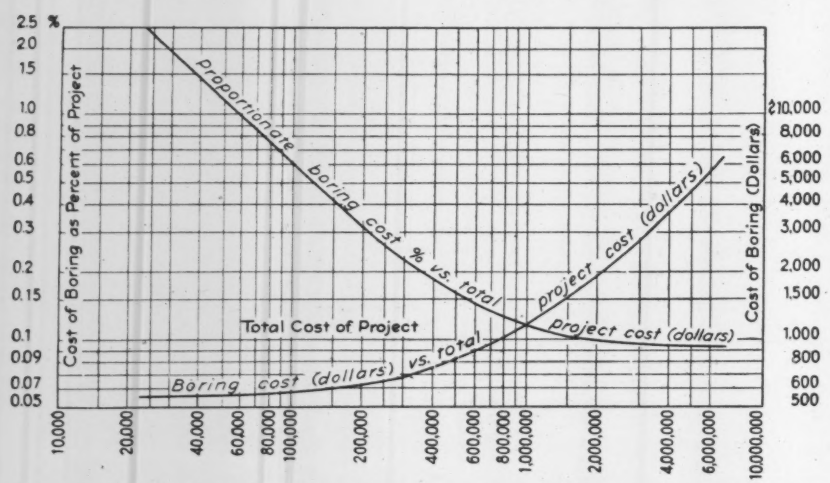
Local variations in substrata

New York City contains about as much variation in subsurface conditions as any city on the Atlantic seaboard. The substrata include everything from the softest clay to the hardest rock. Either of these extremes may occur at the surface, or may lie several hundred feet below it. Rock may outcrop at both ends of a city block, but it may be found that the rock between outcrops has decayed to depths of forty or fifty feet, following one of the many geological contact zones that occur in this area.

The limits of the city inclose an unusually higher percentage of shore zone and swamp property, whose margins have been shifted many times both geologically and artificially. They have been altered by stream and wave erosion, sedimentation, and recurrent glaciation. Within the past few hundred years they have been strikingly altered by man, and the records of important changes have not been preserved. In addition to the natural hazards of irregularity of soil and rock, the effects of future construction must be considered as it is reasonably certain that at some future time there will be disturbance of soil or groundwater in the vicinity.

In addition to the difficulties resulting from natural conditions, the city has suffered somewhat from the handicap of a necessarily complex organization and a certain amount of duplication. New York has many independent engineering offices and design agencies, responsible for overseeing a tremendous volume of public construction ranging from small one-story buildings to large tunnels, sewage treatment works and bridges. Although considerable administrative improvement has been achieved through consolidations effected under the new city charter, the very differences in the type and uses of this wide variety of construction will always require the employment of separate staffs of specialists entrusted with carrying out the various construction functions.

In addition, the city has been faced with wide fluctuations in the volume of each separate class of such work.



Smoothed curve showing relation of boring cost to total cost on 25 projects.

and must continue to expect this condition. It cannot maintain a maximum engineering staff to cover requirements and the size of its various staffs must be adapted to the average. Consequently, when an overload of construction occurs in a city division, it is necessary to employ outside consultants to plan and administer some part of this work.

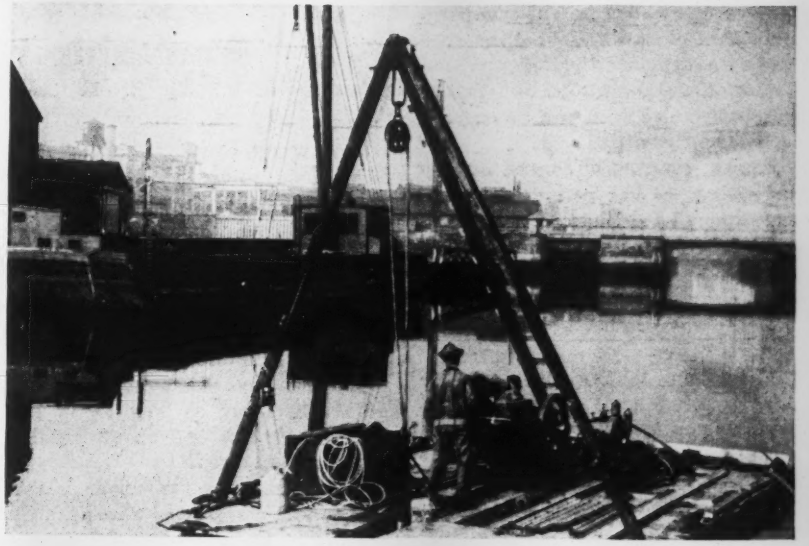
Under such conditions, a certain amount of confusion and overlapping has prevailed in the city's subsurface exploration work. Each division and each consulting firm has had its own specifications, its own procedure for contracting for the work, and its own kind of inspection. Finally, there are varying degrees of cooperation or exchange of information with other agencies.

Specifications for subsurface borings have varied widely in New York City. Usually an attempt is made to attain flexibility by providing for "additional holes as directed," or "deeper holes as directed," or change of location when required, etc. Specifications of method of sampling also show widely differing approaches. Samples are to be bottled in "square" or in "round bottles" they are to be labeled "by the driller," "by the inspector" or even by a "licensed engineer"; they are to be obtained by driving a "2-in. sample spoon," or a "3-in. spoon," by using a 150, 250, or 300-lb. hammer. Water pressure is seldom mentioned, casing blow records only occasionally.

The material sampled is to be "completely described by the driller," or by the "drill foreman." Seldom is any attempt made to give the describer of samples a guide or norm to help him in his description. It is usually not expected that he will comment on the state of compaction or consistency of the soil penetrated. He may not be required to differentiate between a cobble and a boulder.

The transmission of boring records is often (at least the specifications so state) a responsibility of the boring contract. Sometimes the owner requires an inspector of his own to be present while the borings are being made. This is more for the purpose of seeing that the borings are actually made than as any check on the accuracy of the conclusions drawn by the driller.

The survey of boring locations and surface elevations is not made with uniformity; in some instances the boring contractor is required to submit the survey, made and attested by a licensed surveyor, and in other cases the interested department makes its own independent survey.



Boring from scow at site of bridge over Dutch Kills on Queens high-level approach to the Queens-Midtown Tunnel.

From the foregoing it is easy to see that it is difficult to produce an equitable contract for boring in New York City. Common practice has been for the city departments to have borings made either on open market orders (for work not exceeding $1,000 in value) or on a competitive bid basis. On this work, especially on a small contract, a large boulder or a slanting seam of decomposed rock may cause such trouble and expense as to force abandonment by the contractor. The only relief a contractor can find in such a situation is in additional work orders, skimping on quality and quantity of sampling, and hoping for better luck on future contracts. None is equitable or conducive to the best work and recording of data.

Job and cost record

The Boring Section of the Department of Public Works has already completed the investigation, including borings, of more than 25 city-owned sites for municipal construction, ranging from locations for fire stations to large sewage treatment works. The total cost of these construction projects is over $16,000,000. The subsurface investigations cost $23,000 or 0.144 percent of the overall cost.

The cost of the exploratory work has been slightly below the estimated cost of borings made under the contract system, and considerably below the combined cost of such borings plus owner supervision. The accompanying chart, based upon the first year of operation, shows the ratio between cost of exploration and total project costs. It is probable that soil mechanics studies made in connection with the larger construction projects will slightly change this ratio in future work.

Advantages

The advantages derived from the work thus far accomplished by the new section may be briefly summarized.

First, preliminary estimates of subsoil conditions and possible excess foundation costs are made by this section prior to definite planning and purchase of property.

Second, boring work is closely adapted to the nature of the site and the character of the structure. On all sites where previous exploration and construction or the known geological history of the vicinity cannot guarantee the existence of stable materials one or two borings are made immediately. If undesirable materials are found, subsequent borings are made, employing large casings if necessary, to permit collection of "undisturbed" samples. Appropriate tests in the laboratory will then determine probable behavior under load.

Third, during the progress of borings, designers are kept advised of conditions as they are disclosed. Sometimes the proposed location of

structures or heavy loads within the site can profitably be shifted at an early stage of exploration. If the originally planned investigation gives information insufficient in any particular, additional work can be ordered before the rigs are moved.

Fourth, centralized control of boring operations has permitted the establishment of definitions and standardization terms. Of paramount importance in transmitting the soil data is a clearly understood "soil language," which must be simple, yet comprehensive.

Fifth (and this is the most outstanding advantage), as the result of having a continuing organization and a continuing program, site after site and area after area are fitted into the plan of the city from the point of view of their value in terms of foundation cost. It is already possible to make fairly accurate estimates of geological conditions and soil bearing capacity in large areas of varied subsurface quality throughout the city, to make estimates of probable costs of borings, to select in advance the appropriate equipment and methods, and to assign to the work the men who are known to be most skillful under the given conditions. In addition, it is possible to give to the designers early advice, in advance of the actual borings, as to what may be expected in the way of special soil and rock behavior.

Future development

The department has a reasonable expectation of being able to improve and develop the business of making test borings profitably by introducing new methods and equipment. The first instance of this was the purchase by the department of two modern high-speed drill rigs. Such equipment, while common in the central states, and in use on the deep rock borings required for the Delaware Aqueduct, had not before been used on municipal work within the city limits. Provision has been made in the city budget for the purchase and testing of improved equipment.

The Boring Section was established on the initiative of the writer commencing its first work in October, 1939. Under J. Frank Johnson, chief engineer of the Department of Public Works, the Section is headed by Dr. Girard E. Wheeler, geologist of the department. Henry D. Hammond is assistant engineer is in charge.

Transferring Sacked Cement From Ship to Warehouse

DELIVERY OF CEMENT for the Lois River Dam in British Columbia involved shipment in paper sacks by steamer to a wharf near the job where the cement was unloaded and stored. Part of the contractor's job-layout problem was to plan for unloading and storing this cement efficiently and at minimum cost and with provisions such that unloading could go on in rainy as well as in dry weather. A total of about 250,000 sacks was involved.

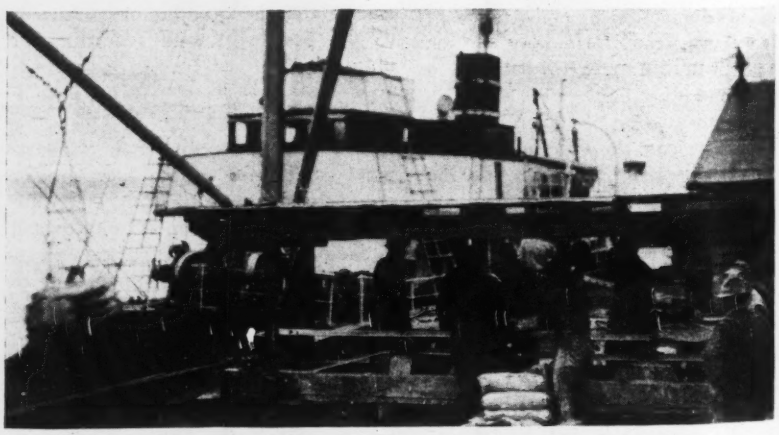
A warehouse (capacity 16,000 sacks) was constructed about 500 ft. from the point where the cement landed on the wharf. Lengthwise of the warehouse roof a monitor was built large enough to carry a belt conveyor with a platform for workmen on either side. Belt conveyors were used exclusively for moving the cement from the ship's slings except for the short distance equal to the spacing of the ship's hatches. For this short distance some cement had to be moved by men with hand trucks in order that two hatches could serve the same conveyor simultaneously.

The cement sacks came up through the hatches in the usual rope slings, 16 sacks at a time, and these slings were landed on the wharf as close as possible to a shuttle conveyor at wharf deck level. This shuttle delivered to a 500-ft. conveyor running into the monitor on top of the warehouse. For the belt speed worked out as best suited to the job, three men worked in the warehouse monitor removing sacks from the belt—the first man took every third sack, the middle man took every other sack and the third man was responsible for all that came to him. From the monitor belt steel chutes led down to whatever part of the warehouse was being filled at the time, one chute for each man unloading from the monitor belt. Because these chutes had to be on fairly steep slopes, the sacks traveled too fast on the bare steel, but a layer of heavy canvas, which lasted throughout the job, gave just the right friction for a desirable speed.

The crew used in the unloading system consisted of 34 men, of whom 12 were in the warehouse and 12 in the hold of the ship. The remaining 10 were employed in trucking to the shuttle belt or transferring sacks from trucks and slings to that belt.

This arrangement worked out very well, as the average rate from ship's hold to warehouse was 2,100 sacks per hour; at times this was speeded up to 2,400 sacks per hour. The average cost, including all labor and supervision in the unloading operation (except the winchman on the steamer whose services were part of the freight charges) averaged less than 1¼c. per sack.

The cement-handling operation was part of the contract carried out for the Powell River Co. by Stuart Cameron Co., Ltd., Vancouver, B. C., contractors on Lois Dam.



Belt conveyors at shipside took sacked cement into warehouse, 500 ft. away, at a handling cost of 1¼¢ per sack.

First Concrete Paving 50 Years Old

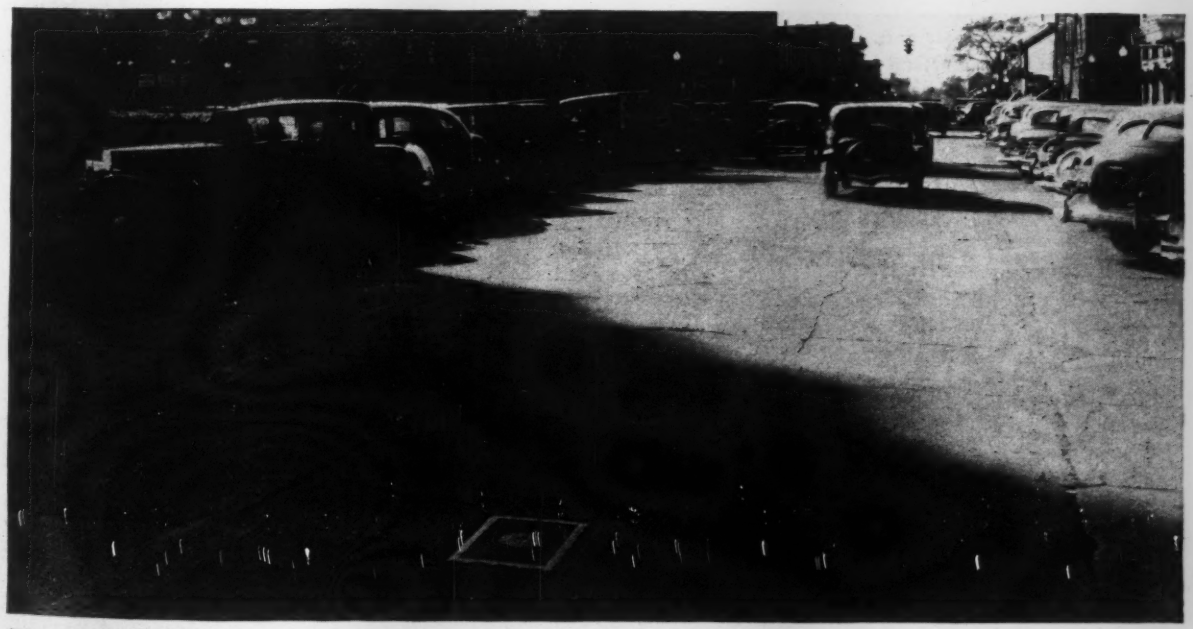
Tracy Bartholomew
Pittsburgh, Pa.

***Contents in Brief**—Laid in Bellefontaine, Ohio, in 1891 by G. W. Bartholomew, the first portland cement concrete paving built in this country has completed a half-century of service. Development of a local cement mill in 1888 resulted in initial city pavements of this type. Personal bond was required to guarantee five years of use. Production of cement and construction of pavement reviewed.*

FIFTY YEARS of continuous service by the first concrete street pavement in America was the important event in civil engineering history celebrated in Bellefontaine, Ohio, June 13, 1941, with the unveiling of an appropriate concrete monument. The four concrete pavements surrounding the court house in the center of Bellefontaine have all been in continuous service for from 47 to 50 years. Constructed without modern machinery for manufacturing the cement, mixing the concrete, or laying the pavement—indeed even without the benefit of previous experience by others, or standards to guide the work—these pavements have already outlived most of the men who built them as well as hundreds of other concrete pavements which were built much later. They have both historic and technical interest and bear incontrovertible evidence both of the fundamental knowledge and integrity of their builders, and of the permanence of well-made concrete. Probably few other street pavements have ever given such long and satisfactory service at such negligible expense for maintenance.

These streets were planned and built in truly horse-and-buggy days: ten years before the day of the automobile, when heavy drays and pleasure vehicles alike ran on tires of steel. In those days, Bellefontaine was a prosperous county seat surrounded by rich farmlands widely known for their heavy Percheron horses. It boasted a thriving factory making hames (even the word is almost unknown now) and another making carriages. Just outside the town, an energetic newcomer by the name of Bartholomew was developing a market for a gray powder he called Buckeye portland cement.

The historic Bellefontaine pavements are undoubtedly the direct result of the thorough studies, sound conclusions and effective efforts of this man. Born in Bristol, Conn., (1848) George Wells Bartholomew, Jr. settled in Texas shortly after the Civil War. As a partner in a prominent wholesale hardware firm in Austin, he handled portland cement



After 50 years of service (1891-1941) the pavement, which was laid in 5- and 6-ft. square blocks, shows its principal wear along the longitudinal joints where the steel tires of the horse-and-buggy days produced excessive abrasion. Note the sharp edges of the transverse joints. In pouring, the blocks were separated by tar paper and were not keyed.

and by 1885 became so completely convinced of its merit and possibilities that he sold his Texas interests and came north to make cement.

Obtaining entry as a special cement machinery salesman, he devoted several months to a study of all cement mills then operating, their products and problems. Reassured, he then surveyed the country from the Hudson River to the Missouri for the most favorable raw materials for processing by the then available machinery. In the meantime, his old friend, George H. Kalteyer, an expert chemist and president of the Alamo Cement Co. of San Antonio, who was to be his silent partner, searched Europe for the latest developments in methods and machinery.

Mr. Bartholomew located and tested the Bellefontaine marl and clay deposits in 1887, completed the mill in 1888, and started shipping cement about Jan. 1, 1889. He was successful in promoting its use not only for foundations and sidewalks, but also for curbs and gutters, and even for "street crossings"—to enable pedestrians to cross streets without getting into the mud.

By Nov. 25, 1890, he had succeeded in having the Bellefontaine council appoint a committee "to ascertain the probable cost of cementing our principal streets, and the advisability of so doing". In 1891, the street commissioner was authorized "to construct, under the direction of G. W. Bartholomew, a cement gutter 8 ft. wide on the west side of Main Street" from Columbus Street to Court Street.

G. W. Bartholomew, who built the first concrete pavement in this country.

This was the first section of concrete pavement in the United States. It was located where wear would be most severe—just in front of a line of hitching rails where the steel-shod Percherons stamped by the hour. Two years later sections of this pavement were removed and exhibited at the World's Columbian Exposition in Chicago where they were awarded the Grand Prize as evidence of the durability of concrete and its fitness for use as a street paving material.

In the same year (1893), Mr. Bartholomew or his company secured a contract under which, using men from the cement mill, he placed concrete pavement on the whole of Court and Opera streets, along two sides of the court house, and, by bond, guaranteed it for five years. In the following year, 1894, Main and Columbus streets, wide arteries on the remaining two sides, were completed under a contract that appears to have been let first to the cement company and then remade to W. T. Snyder, a well-known local cement worker; Mr. Bartholomew again was personally responsible for the results.

The Buckeye Portland Cement Co., which made the cement, was itself a pioneer; the entire American portland cement production, at that time, being less than could now be burned in one kiln or ground in one tube-mill, or about ten times the Buckeye plant capacity. In a day when most cement mills were operated largely by rule of thumb, the Buckeye management, as a result of extensive studies, understood the fundamental requirements for uniformity and dependability of product, and took precautions to attain them, that were unusual in that day. Thus, greater intimacy of raw mix was obtained, even with the inefficient chasers (wet-pans) then available, by selecting the fine soft marl and smooth blue clay available near Bellefontaine for raw materials. Raw mix was further improved, and costs cut, by avoiding the preliminary drying, then common, of either raw material. Uniformity of composition was insured by frequent analysis of the marl and clay, followed by sampling, analyzing and correcting the composition of the mix before discharging the chasers. To permit this, large storage vats were provided over the pug-mills which formed the stiff mud into bricks. These bricks were dried in the sun and burned in double Dietzsch kilns (the first in this country) or in modified Candlot dome kilns. All clinker was hand-picked, reduced by crusher and rolls, ground in expensively maintained buhrstones, seasoned and thoroughly tested before shipment—mostly in wooden barrels.

By present standards, the product might be classed as a coarse Type IV (low heat) portland. Fineness was 98 to 99 percent passing 100 mesh. Analysis approached 63.5 percent CaO, 1.75 percent MgO, 22.25 percent SiO_2, 7.0 percent Al_2O_3, 2.75 percent Fe_2O_3, 1.25 percent Alkalies, and 0.75 percent SO_3. Set was normal and tensile strength was 175 and

Getting slicked up for its 50th anniversary celebration, the concrete pavement still shows the original 3/16-in. indentations made to minimize the slipping of horses. Members of the Junior Chamber of Commerce are cleaning the pavement for the ceremonies, which were held on June 13.

300 lb. per sq.in. respectively, at 7 and 28 days, made 1:3 with crushed granite and the Boehme hammer apparatus. High early strength was not sought, Mr. Bartholomew's insistence being for a good increase in strength from 7 to 28 days rather than on high 7-day results followed by a smaller increase.

The pavement slabs laid in the 1890's were designed largely from sidewalk experience. The concrete was 6 in. thick, laid as a 4-in. base and 2-in. wearing surface, in blocks about 5 to 6 ft. square. Aggregate for the base coarse was a good clean, coarse bank gravel (about one-third sand), which was used without washing or separating; for the wearing course, clean sharp sand up to $\frac{3}{8}$ in. was used. In one section, at least, (probably north end of Opera St.) glacial flint boulders (niggerheads) were collected, crushed on the job to $\frac{3}{8}$ or $\frac{1}{2}$ in. and used in the top course to increase resistance to wear.

In the earlier (narrower) streets, the slab was placed directly on the well-rolled old gravel subgrade and the proportions of the concrete mix are said to have been 1:5 for the base and 3:5 for the top course of the pavement.

In the later (wider) streets, an 8-in. rolled sub-base of crushed limestone was used, with 4-in. tile under the curbs. The proportions of the mix were 1:4 for the base and 1:1 for the top course. Sewer pipes and outlets were here installed which, although unused for twenty years, have since functioned perfectly for nearly thirty.

Mixing of the concrete was first done by hand shovels on a wooden platform. Later a large screw conveyor from the cement mill was adapted for continuous operation. Aggregates were measured in wheelbarrows. Control of water was constant and rigid, the goal being "the least practicable". "Knowing that, because of fine sand and double the amount of water needed, many concretes have less than 25 percent of the strength they should have", as Mr. Bartholomew wrote later, he kept the mix so dry that, after vigorous ramming into place with 8-in. square, 35-lb. iron tampers, only a thin film of water was brought to the surface. The wearing course, mixed just as dry, was placed immediately upon the base course and rammed just as hard, to produce maximum density. A light sprinkling of water was necessary to permit smoothing with a wooded float.

Modern traffic using the 50-year-old original concrete pavement on the streets surrounding the Bellefontaine court house.

The surface was specially treated to minimize the slipping of horses. On the narrower streets a special tool was used to make grooves about 1 in. wide and $\frac{3}{16}$ in. deep at the center, which quadrilled the surface into 4-in. squares. On the wide streets, a roller imprinted $\frac{3}{16}$-in.-deep depressions on 2-in. squares.

The 5- to 6-ft. blocks were separated by strips of tar paper. These have proven to be entirely adequate to avoid troubles caused by volume changes. Those running transversely have never been maintained nor repaired, show but little wear, and are generally still in good condition. In the light of fifty years' experience, it may be said that the longitudinal joints were the only important mistake made by the designers of these pavements. They chipped and wore badly, especially when steel tires were permitted to travel in them.

A report made in 1917 by Clair A. Inskeep, director of public service for Bellefontaine, stated: "The body of the blocks is in excellent condition. The only deleterious wear has been along the longitudinal joints, and this after being subjected to the heaviest traffic of a town of 10,000 inhabitants for a period of 24 years. Had the longitudinal joints been eliminated, it is the opinion of this writer that *no* repairs would have been necessary to this date. By repairing some of these joints which have worn badly, these streets could be put in as good condition as they were the day they were opened for traffic.

After another twenty-four years, the same statement can properly be repeated today. The blocks are still in excellent condition, cracks are noticeable by their absence, wear on the surface and on the transverse joints is still insignificant. The only deleterious wear has been in the longitudinal joints.

These pavements, comprising some 7,500 sq.yds., have been repaired only 8 or 10 times since they were built. Their original cost was $2.15 to $2.25 per sq.yd., including curbs (built integrally) and backfilling of the drains. The total cost of all repairs and maintenance to date has been about $1,000. To repair again now and put the surfaces in substantially "as good condition as the day they were opened for traffic" could hardly swell the total expense to more than $1,500. This is only 15c. per sq.yd. for 50 years of maintenance.

When these pavements were ten years old, Prof. F. H. Eno reported (*Engineering News*, Jan. 7, 1904): "With the extremely small amount of repairs which the streets show to have been done upon them, they have certainly been an economical investment for the city." After nearly forty more years of satisfactory service without appreciable expense for maintenance, "economical investment" is hardly strong enough to describe what appears to be a truly "low cost road".

Samuel A. Buchanan was city engineer of Bellefontaine when the first streets were laid. The maintenance costs were furnished by Mr. Fulton, present assistant city engineer.

Factors in Aerial Bombardment Protection

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***Contents in Brief**—Following a discussion of the forces of bomb impact and explosion, the static-load and energy methods of designing structural members to withstand bombing are reviewed. Methods of protection against fragmentation, blast, and suction are then considered, together with provisions for safety zones in existing buildings.*

AERIAL BOMBARDMENT has brought new and serious problems to American engineers. True, our cities have not yet been bombed—but dare we say they will never be bombed, now or in the future? In the light of past history and current scientific achievement, we must conclude that the United States is neither insured against war nor immune from aerial attack. The frightful havoc and devastation now being visited upon civilian populations in Europe and China may be visited upon almost any city in the United States by future long-range bombers capable of flying at high speeds with heavy loads.

What are we going to do about it? Shall we wait until New York City, or San Francisco, or New Orleans, is bombed before we start planning the measures that must be taken to protect life and property and insure the functioning of essential civilian activities under war-time conditions? Millions of dollars are now being spent to develop an unparalleled military machine, but on the other hand, virtually nothing is being spent on civilian protection, even though the old concepts of warfare with front lines and restricted military zones have been thrown overboard completely. The theater of operations in modern warfare embraces entire countries and their populations, both civilian and military. The War Department knows this and it recognizes the interdependence of citizen and soldier. Nevertheless, the War Department cannot provide civilian protection. That is a responsibility which must fall in large part on the shoulders of American engineers, and, in particular, upon civil engineers.

To embark now upon a vast nation-wide program of shelter construction to house millions of people is not necessary, even if we could afford to do so, but it is necessary to study the effects of modern bombing, and then in the light of that knowledge to make new and existing structures and facilities safer, so as to reduce civilian casualties and damage to a minimum in the event of attack.

We must proceed at once to evaluate shelter zones in existing buildings and other structures, and to devise measures to reinforce them. And we must take steps to reduce the fire hazards from incendiary bombs; to protect water supply, sewer, gas, and power systems; to safeguard vital transportation links; to assure that industry can function under war conditions; and to change building code regulations and to adopt new appropriate construction practices. All this is necessary if our future structures are to be better equipped to resist bombing.

Taking first things first, what loads do aerial bombs make it necessary to design for? When an engineer is confronted by a new problem involving forces different from those previously encountered, it is only natural to try to use fundamental procedures of design used on familiar problems. Structural engineers are accustomed to thinking in terms of static loads. It is true that dynamic effects are often encountered, but such effects are generally replaced by "equivalent static loads."

Static-load method unsatisfactory

Consider the impact of a 500-lb. demolition bomb with a terminal velocity of 1,000 ft. per sec. If the bomb strikes a concrete slab and is brought to rest in 2 ft., with a uniform deceleration, the equivalent static force is approximately 4,000,000 lb. This is only the force of impact and does not include that of explosion. Thus, the impact effect expressed as an equivalent static load, is many times the bomb's actual weight.

If a reinforced-concrete slab, in a typical slab, beam, and girder layout, is designed to resist a concentrated load of 4,000,000 lb. in accordance with usual design practices, enormous thicknesses of slab are obtained, even with extremely high unit stresses and with diagonal-tension reinforcing. The thickness may be as much as 15 ft., depending upon the unit stress and the effective width of impact load distribution. A designer proceeding with detailed calculations for such a slab will immediately recognize the uncertainty existing as to the effective width of the distributed resistance. It will also be found that diagonal tension (or shear), rather than moment, governs the required depth. When an attempt is made to design an adjacent beam or a girder, the resulting dimensions may be the same as those for the slab. In other words, the slab, beam, and girder framing disappears and becomes an enormous flat slab.

• Since January large groups of practicing engineers and architects representing many different organizations have been meeting at regular intervals at New York University to study the unusual problems created by aerial bombing of a modern city and how to provide protection for civilians against such action. In this article the instructors in charge of those meetings present a summary of the facts they have collected and the conclusions they have reached with respect to bombing damage. In a second article in an early issue the construction of bomb-resistant structures will be discussed. —*Editor.*

It may be that the ordinary design procedures have no significance whatever in this problem involving a relatively small load traveling at a high velocity. Instead the old idea of "punching shear" may achieve a new significance, for when high-speed photographs of bullets penetrating plates are studied, the effects seem to be quite localized in nature. Actual span length seems to have little importance. In other words, bending may also be so localized that our ordinary conception of bending moment involving reactions and lever arms may mean nothing.

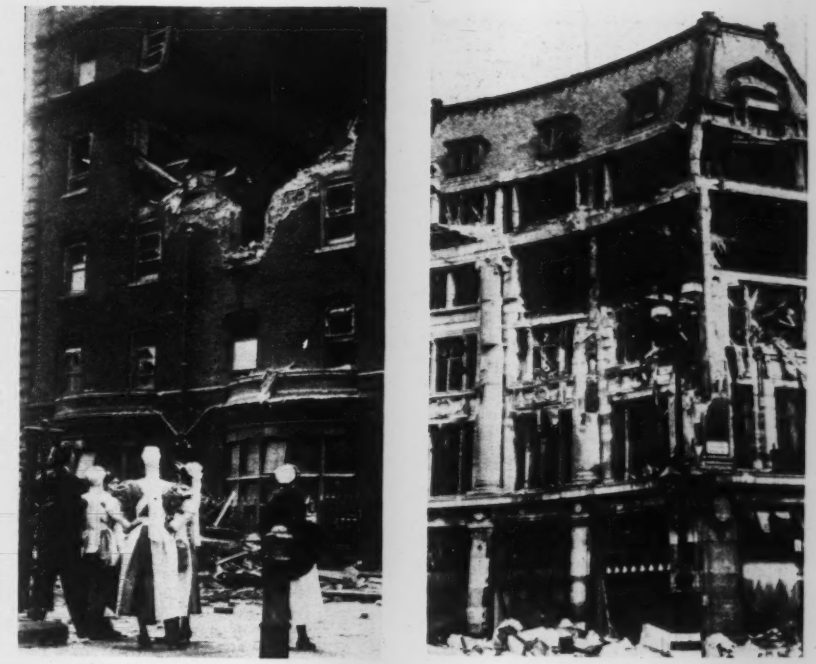


Fig. 1. Angle hits are much more frequent than vertical ones, as these views show. Windows or light curtain walls that blow out under blast often minimize structural damage.

Designing for energy loads

Structural design based on "equivalent static loads," and in accordance with usual rules, does not seem to be a satisfactory way to treat the hits of aerial bombs. Is it possible to deal with the actual energy values instead? The kinetic energy at impact of a 500-lb. bomb with a terminal velocity of 1,000 ft. per sec. is 94,000,000 in.-lb. But this is only the energy of impact; the explosion energy may be forty or fifty times as much.

When one studies the problem of designing for energy values, little scientific data are available to guide the design procedure. The energy absorption values of various structural materials can be found from stress-strain curves for specimens tested at relatively slow speeds in tension or compression. A cubic inch of medium carbon steel can absorb about 30 in.-lb. of energy below the yield point. This is a measure of its resilience. On the other hand, the same material can absorb about 16,000 in.-lb. up to its ultimate strength. Likewise, a cubic inch of concrete can absorb from 5 to 30 in.-lb. of energy up to the ultimate strength. The value is very uncertain, but it is evident that steel is much tougher than concrete, since toughness is measured by ultimate-energy capacity. In order to utilize energy capacities efficiently, stressing the steel to values in the plastic range or as high as 50,000 or 60,000 psi. is necessary. Such values would give a factor of safety of approximately two in terms of ultimate energy capacity.

If a steel block is assumed to absorb all of the energy of impact uniformly, to withstand a 500-lb. bomb striking with a velocity of 1,000 fps. per sec., a volume of 11,800 cu.in. is needed. What shall be the dimensions of the block? Shall they be 1x1x11.800 in.? Or 20x20x30 in.? There is little knowledge available to guide the selection of proportions. It may be that the velocity of transmission of the energy wave may be a factor in the selection of suitable dimensions. If so, the velocity must be determined for materials in the plastic rather than in the elastic state. If one wishes to use concrete, a cube 15x15x15 ft. is needed to absorb the energy of this impact uniformly, if each cubic inch is given a value of 15 in.-lb. Since we cannot predict the exact points where bombs will strike, must we fill our buildings with 15-ft. cubes of concrete? That would be an absurd expedient.

How about designing beams for energy loads? If stresses are kept below the elastic limit, the volume of a simply supported beam to resist an energy load concentrated at the beam's center is nine times the volume of a block stressed axially and in which a uniform state of stress exists. If stresses are permitted to exceed the elastic limit in order to take advantage of the great reserve of energy in the plastic range, the volume required is still outside the realm of practical consideration.

Designing for direct hits in terms of "energy values" seems to be just as unsatisfactory as designing for "equivalent static loads." And in both cases, the shattering forces released by the explosion are even more difficult to evaluate. Since there is little accumulated data upon which to base reliable design procedures, it may be that empirical observations of the behavior of various structures and structural materials under active bombing tests will supply the major guides for the proportioning of structural units to resist the tremendous forces of modern bombs.

Bomb explosive characteristics

Most demolition bombs are equipped with delayed-action fuses. This enables the bomb to penetrate into a resistant material or to perforate roofs or sidewalls and several floors of a structure before the explosion occurs. Considerable test data are available as to the penetration of bombs into various substances and a number of formulas have been proposed for estimating penetration.

These formulas cannot be discussed here in detail, but the Poncelet "sectional pressure" formula based upon the theory developed in 1829 by J. V. Poncelet in his book "Cours de mécanique industrielle" appears most satisfactory.

The formula is:

$$d = \frac{W}{2Agbi} \log_e \left(1 + \frac{b}{a} V^2\right)$$ where

d=maximum penetration depth of bomb in feet,
W=bomb's weight in pounds,
A=cross-sectional area of bomb in square inches,
g=acceleration due to gravity in feet per second per second,
a and b=constants depending upon material which bomb encounters,
V=bomb's terminal velocity in feet per second, and
i=form factor for bomb.

The experimental program of the Metz Committee (1835) developed initial values for the constants in Poncelet's formula. Since then many additional tests and observations on penetration have been made, and a test program is now in progress at the Aberdeen (Md.) Proving Grounds. However, to obtain consistent data is difficult, and estimates of penetration into materials such as earth or concrete may involve considerable error. The tests do, nevertheless, supply a basis for estimating required thicknesses of so-called "burster slabs" or protective mats which are generally placed on the earth's surface to protect underground structures. Calculations reveal that a concrete burster slab having an ultimate strength of 3,000 psi. should be at least 4 ft. thick and supported at all points by underlying soil to stop and detonate a 500-lb. bomb traveling with a velocity of 1,000 fps.

When a bomb explodes, the case bursts into many fragments, which are thrown outward and upward at high velocities. This is known as fragmentation. The hot gases formed by the combustion of the high explosive expand at a tremendous rate. For a distance of from 20 to 30 ft. from the bomb there is a "zone of expansion" in which violent, disruptive forces are manifest and in which materials are shattered. The tremendous expansion causes a blast wave to be propagated through the air. This wave has a high-intensity pressure phase of short duration followed by a low-intensity suction phase of longer duration (Fig. 2). Intensities drop off rapidly as the distance from the point of explosion increases. Various formulas have been proposed for determining blast pressures, for the most part based upon experimental measurements obtained with the aid of blast meters stationed at varying distances from the explosion and are therefore subject to some uncertainty.

Fig. 2. Pressure-time curve for a 500-lb. bomb exploding at a distance of 50 ft.

MATERIALS THICKNESSES TO PROTECT AGAINST BOMB FRAGMENTS*

Mild steel plates	1½ in.
Solid brickwork or masonry	13½ in.
Reinforced-concrete	12 in.
Plain concrete	15 in.
Earth or sand	30 in.
Ballast or broken stone	24 in.
Wood, minimum	40 in.

* Data are for a 500-lb. bomb exploding 50 ft. away.

If a bomb penetrates into earth and then explodes, a crater is formed and a violent earth-shock results. Various empirical formulas have been proposed for determining crater dimensions and the radius of damage from earth-shock, but it should be kept in mind that constants which make the formulas workable must be determined by explosive tests, which admit of considerable variation.

Perforation by bomb fragments

There is a considerable amount of data available on the resistance of various materials to perforation by bomb fragments. There is also information, most of it qualitative, about blast or concussion effects. More data based on actual bombing of cities will eventually be obtained from foreign sources. Based upon the data now available, arbitrary thicknesses of various materials are recommended to provide resistance to perforation by fragments, but these recommended thicknesses are in terms of the medium-weight bombs in use today. Their effectiveness against heavier bombs, which may be developed in the future, would naturally be reduced. The above table gives thicknesses recommended by British authorities for protection against fragments from a 500-lb. bomb exploding 50 ft. away.

Wall panels to resist blast

The problem of designing wall panels to resist blast pressures and earth-shocks is a fascinating one and offers considerable opportunity for research. The intensities of pressures and suctions in a typical blast wave passing a fixed point are shown in Fig. 2. If blast meters are installed at a number of points, curves like those in Fig. 3 may be plotted to show the maximum pressures at varying distances from the explosion. But the equivalent static pressure or suction acting on a wall panel or building is associated with the period of vibration of those structures. A panel with a high natural frequency, say greater than 30 cycles per second, may be subjected to equivalent static pressures and suctions greater than the actual intensities in the blast. Buildings as a whole, however, have low frequencies, generally less than 4 cycles per second; the Empire State Building has a frequency of ⅛ of a cycle per second. Consequently, before the building as a whole has a chance to react violently to the blast wave, the pressure and suction have disappeared. The building will vibrate but the equivalent static forces are relatively small. Fig. 4, reproduced from a diagram in British Handbook No. 5, *Structural Defence*, shows the relation between equivalent pressures and frequencies.

A rectangular wall panel 40 ft. away from the explosion of a 500-lb. bomb might possibly be subjected to an equivalent static pressure of 1,730 lb. per sq. ft. and to an equivalent suction of 865 lb. per sq. ft. With a maximum unit stress of 40,000 psi. a solid steel plate panel 12 ft. high and 18 ft. long would have to be 1½ in. thick to withstand this high pressure. This is the same thickness required for splinter protection. Moreover, supporting details along the edges must be such as to develop resistance against the suction forces as well as the positive pressure.

A panel of the same dimensions, but made of reinforced concrete, must have a total thickness of 9½ in. However, this is less than the thickness of reinforced concrete recommended to provide protection against the perforation of splinters. The accompanying table shows that a 12-in.

thickness is needed. Consequently, if splinter-proof walls of reinforced concrete 12-in. thick are used, they should be more than sufficient in general to resist the blast of a 500-lb. bomb 40 ft. away.

The possibility of cellular steel walls composed of two steel plates stiffened with diaphragms and with the cells filled with sand or some similar material should not be overlooked. Brickwork laid in portland cement mortar is another possibility, and tests have demonstrated that such panels have a surprising amount of resistance, even though they are not reinforced with steel to take tensile forces.

There is a difference of opinion as to the advisability of fastening outside wall panels securely to the structural frame of buildings. Some engineers believe that panels should have planes of weakness along all the edges so that they will be easily blown in or blown out, thus eliminating any possibility of high blast pressures being transmitted to the structural frame. The authors do not agree with this viewpoint, maintaining that a greater measure of safety is associated with the practice of making exterior wall panels continuous with the structural frame and securely bonded to it. If hits occur outside the structure, there is less danger to occupants and equipment within. In addition the anchored panel will withstand greater blast forces.

If there is an inside hit and subsequent explosion, there will be less debris blown out into adjacent streets, even though localized damage in the building may be greater. If weak panels are used and a column is blown out—and it may be destroyed by close explosions or direct hits, regardless of whether the panel is weak or strong—then there is nothing to take the place of the column. With continuous bonded panels, however, the walls themselves will tend to act as huge vertical girders in case the column section is destroyed and will tend to distribute the load to other columns. Moreover, it is doubtful if the high pressure acting on the panel for a very short instant of time, and associated with the high frequency of vibration of the panel, will be transmitted to the frame as a whole because of the low vibration frequency of the frame. Even if some of the force is transmitted, in tall buildings over 15 stories in height, no increases in column sections will generally be needed. In low buildings, however, it may be necessary to increase somewhat the sections of outside columns and to provide better moment-resisting connections.

Shelter zones in existing structures

One of the most important tasks of technical personnel associated with local defense councils is that of evaluating and classifying shelter zones in existing structures. In metropolitan areas, such as New York, the skyscraper building immediately comes in for attention. The tall, steel-frame building with moment-resisting connections will survive tremendous shock, and it would be extremely difficult to cause the collapse of an entire building. However, severe localized damage can be caused by direct hits, and thus to classify those zones within the building which offer the greatest protection is important.

Considerable erroneous information has been circulated about skyscrapers subjected to aerial bombing. It has been claimed that the roof target is so small there is little chance of a direct hit. Such a statement overlooks the side wall target, for a bomb may strike at an angle of 19 deg. with the vertical when dropped from an elevation of 10,000 ft. How the side of a tall building may present a target 140 ft. wide and 581 ft. long is shown by Fig. 5. This target could be hit repeatedly by bombers at high altitudes.

Statements have also been made that even if the sides of a tall building were hit, the bomb would ricochet and plunge downward to the street below. This statement is also erroneous, since the horizontal force required to change the direction of the bomb is much greater than the horizontal force required to punch a hole through the side wall of a typical office structure. We must also remember that a large proportion of the side wall area is devoted to windows offering practically no resistance to a bomb's impact.

After perforating the side wall, a bomb may pass through a number of floors and possibly an interior partition wall before coming to rest and exploding. British engineers state that a 500-lb. bomb can perforate a roof and five 6-in.-thick floors of reinforced concrete. Many New York office buildings have cinder concrete floors only 4 in. thick and lightweight partition walls. There are no data available on the number of 4-in. layers of cinder concrete required to stop a heavy bomb; to conclude that ten floors might be perforated does not seem far-fetched.

Tracing the possible path of a bomb penetrating a building reveals that it might often stop in the second bay, a space often devoted to interior corridors. When one studies a typical layout for a modern skyscraper building with exterior offices, corridors, elevator shafts, and interior service rooms, it is difficult to find any zone that can be classified as absolutely safe against the effects of a direct hit. On the other hand, there is no ques-

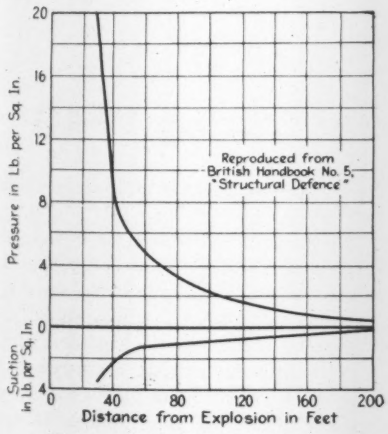
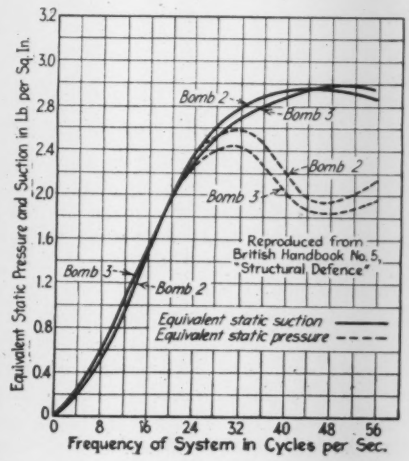

Pressure in Lb. per Sq. In.
Suction in Lb. per Sq. In.
Reproduced from British Handbook No. 5, "Structural Defence"
Distance from Explosion in Feet

Fig. 3. Maximum blast pressures and suctions from the explosion of a 500-lb. bomb. These data are based upon measurements obtained from bomb explosions under test conditions.

Fig. 4. Relation between equivalent pressure and frequency of a structural system as determined by mathematical investigations of actual blasts.



tion but that corridors and rooms in the interior bays are safer than outside offices. Moreover, those interior points can be made very much safer in existing buildings by reconstructing corridor walls. Partition walls between offices and corridors should be of heavy, splinter-proof construction, either of solid brick or reinforced concrete 12 in. thick. Glazing along the corridors should be kept to a minimum. To reinforce interior service rooms and toilets and walls around interior fire stairways in present building is also possible and would provide greater protection.

Interior safety zones are not available on every floor. In most of the present office buildings the upper ten stories should be completely evacuated during air raids, depending upon the type of floor slab. In new buildings all floor slabs should be made of 6 in. of reinforced concrete or its equivalent, which is thicker floor than with most existing structures. Regions beneath elevator machinery should definitely be avoided in choosing safety zones.

Lower stories of tall buildings usually incorporate several additional bays, depending upon the width of the setbacks to the tower portions of the structure. In general, the interior zones in lower stories are safer than the corresponding zones in upper stories, because of the larger number of exterior bays. Moreover, if the outside walls of the first three or four stories above street level are made blast- and splinter-proof, large shelter zones may be provided that are quite safe. Unfortunately, the lower floors of most office buildings are devoted to stores with large shop windows, constituting a serious potential hazard.

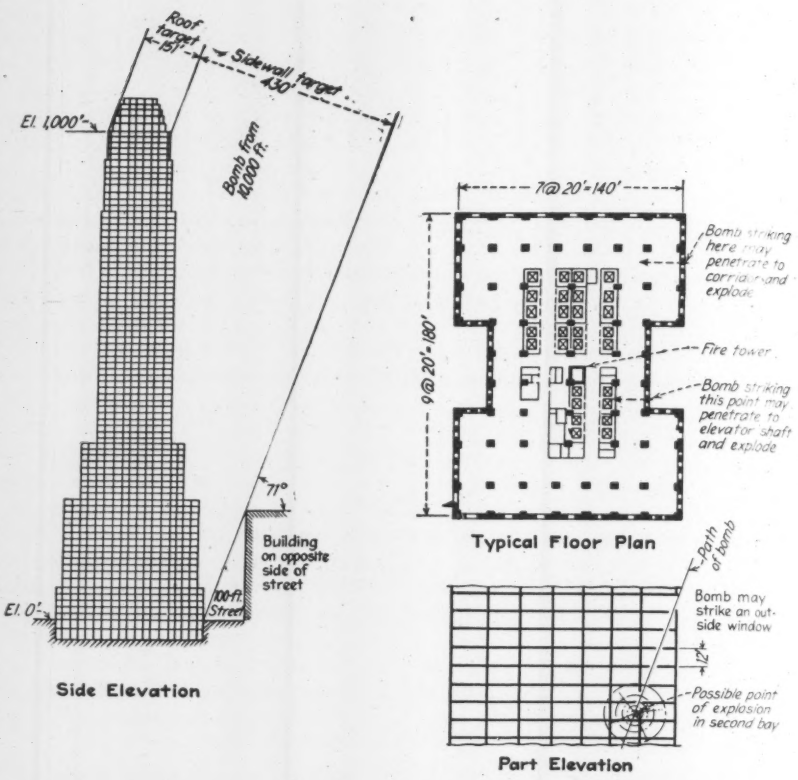


Fig. 5. Diagrammatic sketch of possible direct hits on a skyscraper during an aerial bombardment, indicating where bomb may penetrate structure.

Basement safety zones

Heavy basements and sub-basements often incorporate interior rooms capable of being used as shelter zones. Dangers from flooding and gas pockets should be carefully investigated, however, before evaluating basement areas. Exterior basement walls should be studied in order to see whether there is sufficient resistance against earth-shock. Also, water mains in the street may be broken by explosions and basements subjected to severe flooding, unless provisions are made beforehand to counter such conditions.

To find shelter zones offering comparative safety in most buildings under six stories in height is difficult unless they are of massive construction with independent structural frames of steel or reinforced concrete. Every building is a problem in itself, and undoubtedly interior safety zones can be found or provided with slight modifications. However, it is important to recall that buildings of the wall-bearing type may be completely destroyed by direct hits or even by the tremendous concussion resulting from the nearby explosion outside the building.

Intelligent study and classification of shelter zones in existing buildings calls for expert structural engineers or architects thoroughly familiar with the effects of bombs upon structural materials and various types of buildings.

More Timber Treated During 1940

There was an increase of 8.26 percent in the amount of timber subjected to preservative treatment during 1940 as compared with the previous year, the total going over three billion board-feet, according to the 32nd annual report on timber treatment compiled by the U. S. Forest Service in cooperation with the American Wood Preservers Association. Railroad ties head the list, as usual, making up 48.2 percent of the total, with poles in second place with 28 percent. Heavy timber for bridges, docks and trestles showed a large increase in the volume treated in 1940 as compared to 1939.

In types of treatment, 94.4 percent was done with creosote or creosote mixtures, the remainder being divided between chromated zinc chloride, Wolman salts, zinc chloride, and eleven different salt or oil mixtures.

In 1940, there were 228 wood preserving plants in the United States, with all but five in active operation. The total is made up of 179 commercial plants, 23 railroad plants and 26 owned by public utilities and mining companies.

Siphon Sewer Built Under Difficulties

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***Contents in Brief**—Tunnel and shaft construction under compressed air were required in the installation of a three-tube siphon for the Boston metropolitan sewer system. The work involved lowering an existing siphon, with which was incorporated the construction of two additional tubes. Variations in ground from fine sand to hardpan, and a relatively high water table complicated construction operations.*

To SIPHON SEWAGE under a creek in the Boston metropolitan district called for tunnel and shaft construction under difficult conditions along with the expenditure of about $1,000,000. The work involved lowering an existing sewer to which was coupled the installation of two additional conduits for a new relief sewer. The tunnel has both Gothic arch and circular sections, the latter portions installed with the aid of compressed air.

The old sewer, built in 1895, was carried under Chelsea Creek in East Boston in a siphon 29 ft. below mean low water. Recently the War Department saw fit to dredge the creek channel to a depth of 30 ft., thereby requiring the installation of a deeper siphon. Since a new relief sewer was under construction in this vicinity which also required a siphon crossing, it was decided to combine the lowering operation with the new installation. This called for the construction of a three-tube siphon, 50 ft. below mean low water. Each tube in the siphon is 60 in. in diameter.

A plan and cross-section of the work are shown in Fig. 1. This shows the relief sewer carried across Chelsea Creek in two lines of 60-in. concrete pipe while the old sewer is carried in a single 60-in. pipe. By means of a stop plank arrangement in the headhouse at Sta. 10 it is possible to divert sewage from the old line into the relief sewer siphon lines and to confine the flow from the relief sewers to either or both of the 60-in. conduits.

Open cut and tunnels

Principal features of the work involve the construction of 200 ft. of open-cut sewer, a shaft at Sta. 10, a tunnel between Sta. 10 and 3, and outfall from shaft at Sta. 3, and installation of pumping equipment.

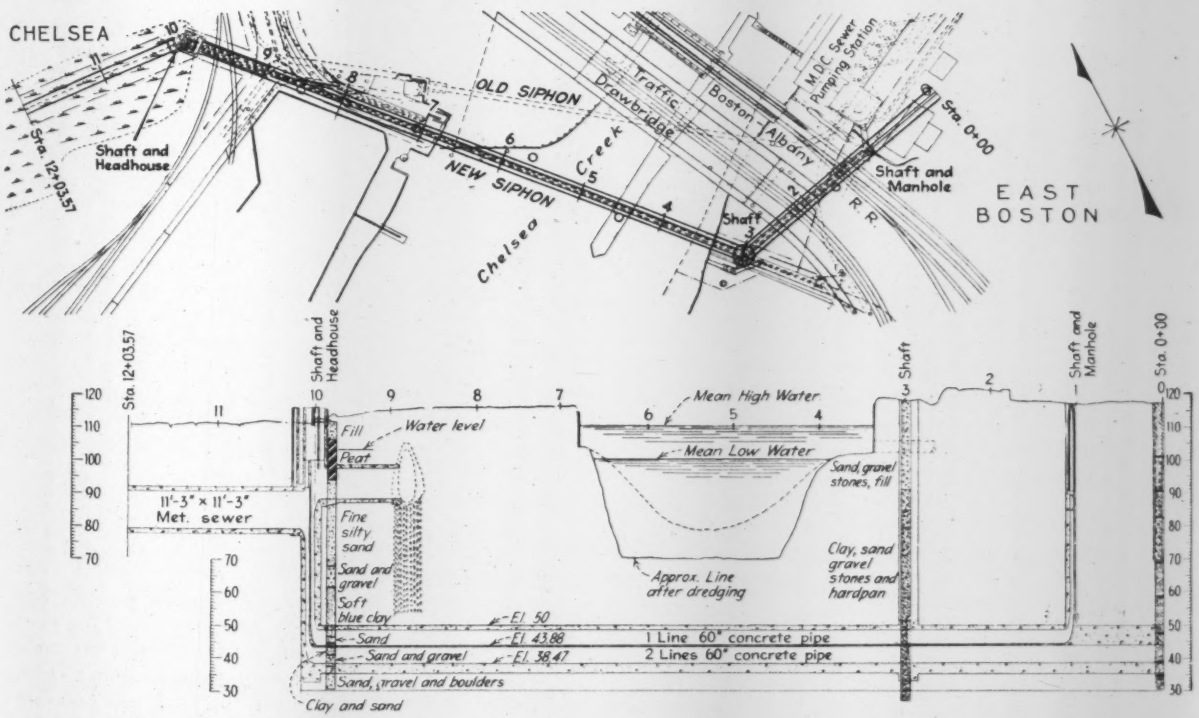

Fig. 1. Principal features of the siphon construction involved an open-cut section between Sta. 12+03 and Sta. 10, tunnels from Sta. 10 to Sta. 0, and shafts at Sta. 1+06, 3, and 10.

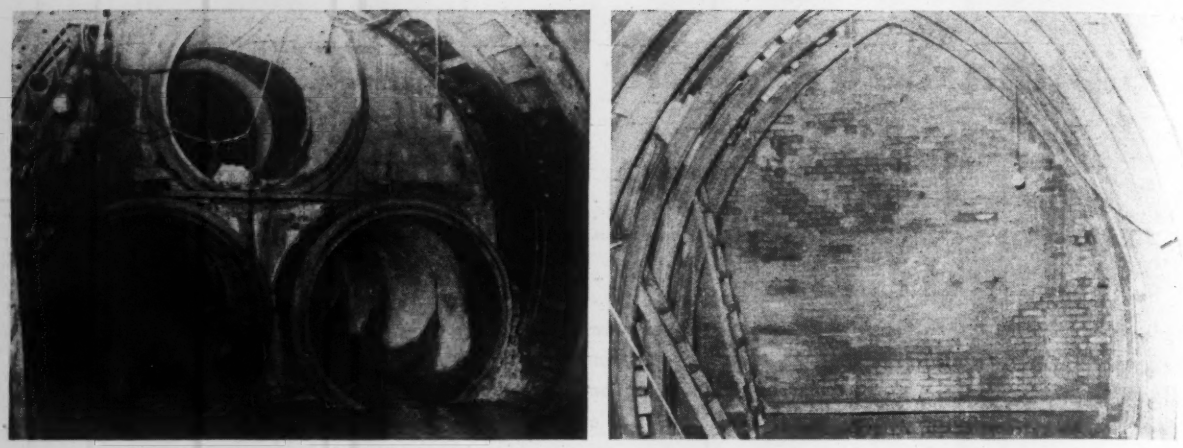

Fig. 2. Three-tube siphon built in a tunnel under Chelsea Creek in the Boston metropolitan district. Circular section (left) was built with a shield under compressed air, while the Gothic arch section (right) was used in free-air construction.

In the 200-ft. open-cut stretch the invert of the sewer is about 32 ft. below ground surface and located in a stratum of fine sand. Heavy earth and water pressures together with a fine sand condition, called for use of steel sheeting and structural steel rangers.

In the construction of the shaft at Sta. 10, steel sheeting 55 ft. long was driven along the outer line of the headhouse. This was braced with structural steel rangers and corner struts that were welded in the field. The sump for the open-cut construction served to drain the portion of the shaft above El. 78 while it was being excavated and braced. A railroad siding near this shaft aggravated surface load conditions and further justified the use of steel sheeting and structural steel bracing in the shaft.

Between El. 78 and El. 32 the shaft was lined with pressed steel plates 1/4 in. thick reinforced with structural steel rib beams. Attempts were made to dewater the shaft by developing a deep well. This effort was successful until El. 62 was reached. Below this point it did not appear practical to continue operations in free air, and the shaft was allowed to flood.

The shaft then was capped with a removable cover, sufficient in size to permit the introduction of a tunnel shield. Excavation proceeded under compressed air, using a maximum pressure of 33 lb. per sq. in. to reach the bottom shaft where a 30-in. reinforced-concrete mat was placed. Before removing the cover, consideration was given to the stability of the shaft and the ability of the liner plates to resist the thrust from the mat when the shaft was decompressed. This led to the decision to strengthen the liner plate walls with an 8-in. brick wall, which was constructed in compressed air.

Thereafter air was released from the shaft and the cover removed to allow introduction of the shield. A structural steel portal was installed to strengthen the sides of the shaft when it was cut to permit tunneling operations. After the shield was lowered the shaft was again capped, loaded with previously excavated material and subjected to compressed air. The portion of the shaft included within the structural steel portal was burned out and the shield driven to Sta. 9. Built-up structural steel liner plates were used in the tunnel construction. When the shield had reached Sta. 9, tunnel operations were stopped for the purpose of constructing horizontal locks in order to achieve greater speed in handling excavation and also to insure the safety of the men.

Shield operation

Material encountered varied from a fine sand to a coarse gravel and then to hardpan, with occasional boulders measuring as much as 1 cu. yd. Concurrent with the shoving of the shield, pea gravel was blown through the liner plate grout holes to insure immediate filling of the annular space between the tail of the shield and the liner plates. Neat cement grouting operations were carried on about 100 ft. behind the tail of the shield. Within 100 ft. of Sta. 3 a full face of hardpan was encountered in the heading.

A concrete invert was placed while the tunnel was under compressed air because it was found that an infiltration of water and fine sand occurred in the bottom of the tunnel when air pressure was reduced. Excavation of the shaft at Sta. 3 below El. 80 had been postponed until tunnel operations had reached this point since it appeared undesirable to risk heading into a free air shaft until considerable assurance could be had respecting the condition of the ground.

The shaft at Sta. 3 presented conditions quite different from those at Sta. 10. At first 40-ft. lengths of steel sheeting were driven with the expectation of penetrating into hardpan in order to seal the bottom of sheeting and thus restrict the flow of water into the shaft. Large boulders and granite blocks in the upper 20 ft. retarded the progress. At times it was necessary to postpone driving of the sheeting, wait for low tides, excavate to the bottom of the sheeting, remove granite blocks, and burn off steel sheeting which had bent out of the interlock.

After sheeting had been driven and shaft excavated to El. 100, driving operations proceeded more regularly to El. 80, below which point the shaft was constructed of 1/4-in. pressed steel liner plates reinforced with structural steel ribs spaced 16 in. on centers. After the erection of three rings of liner plate, the portion of the shaft above El. 80.5 was lined with concrete to seal off the flow of water through the sheeting. Thereafter, excavation and installation of liner plates were postponed until the shield arrived from Sta. 10 and the tunnel had been decompressed. After arrival of the shield, the shaft was excavated to grade and the bottom was sealed with a concrete slab.

Ground in the shaft at Sta. 1+06

and in the tunnels between Sta. 0 and 3 was hardpan. Here the entire shaft was constructed using ¼-in. pressed steel liner plates, reinforced with structural steel ribs placed 32 in. on centers. The tunnels from Sta. 1+06 to 0 and from Sta. 1+06 to 3 were constructed in free air.

An overflow section of sewer, running from the shaft at Sta. 3 to a nearby seawall consists of reinforced-concrete stop plank chamber adjacent to the shaft and two lines of concrete pipe contiguous to Chelsea Creek. Experience at the site indicated that it is expensive and not practical to seal off water in the vicinity of the seawall because of riprap in front of and behind the wall. For this reason the use of precast concrete pipe was preferred to a concrete structure cast in place.

This project, which is being carried on with the aid of PWA funds, was designed and constructed under the direction of Joseph P. Dever, chief engineer, sewerage division, Boston Metropolitan District.

Lack of Written Contract Causes Engineer to Lose Fee

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FAILURE TO OBTAIN a contract "reduced to writing and executed by the parties" resulted in a court decision which prohibited an engineer from collecting the major portion of his fee for services in connection with plans and designs for municipal work for a political subdivision of Allegheny County, Pa. The jury in the lower court found in favor of the engineer for the full sum claimed, but the higher court reversed this decision and concluded with a statement presented by Mr. Justice Maxey, which is significant to all engineers in private practice:

"Persons intending to enter into legal relations with a borough which will obligate the latter to expend 'over $500' on contracts or for purchases must see to it *at their own peril* that the contract is in writing and that all other statutory requirements in relation thereto are obeyed. If the requirement of the statute can be set aside every time its application seems to work an injustice to one who has furnished to the borough materials or services worth over $500, the statute would be defunctionalized whenever any court felt that injustice would result from its application."

James A. Angelotti of Wilmerding, Pa., a registered surveyor in Pennsylvania, who had been the borough engineer for Rankin County (political subdivision near Pittsburgh) during previous years, submitted a proposition in writing to the borough council for furnishing engineering services covering a project that was to be carried out with the financial assistance of the Works Progress Administration.

According to the minutes of the borough council, he "was employed, authorized and engaged to furnish all engineering services and prepare all the engineering data, plans and specifications for a Works Progress Administration project in said Borough of Rankin, embracing new construction and reconstruction of public thoroughfares, installation of water lines and sewer lines and such other public improvements as the Council of the Borough of Rankin may designate."

According to the plaintiff, he was to have been paid 6 percent of the estimated total cost of the project for this engineering work. With these costs estimated at slightly more than $253,000, his claimed compensation was in the sum of over $15,000.

Upon the acceptance of his proposition for supplying these engineering services he resigned his position as borough engineer and undertook the work, receiving eight installments of $500 on account of his fee. On the conclusion of the work and the submitting of the final bill, the new borough council refused payment.

Incidentally, as part of the presentation made by the defense, an amended answer alleged that the plaintiff was not entitled to recovery as he was not a registered engineer licensed to practice in the State of Pennsylvania. The trial judge ruled that the work that he had done could have been done under his license as a registered surveyor. Further, to protect himself, the plaintiff had engaged the services of a consulting engineer, who was registered to practice in Pennsylvania. The appellate court held that since it had been decided the plaintiff could not recover because there was no written contract, it would not be necessary to consider the other objections which had been raised.

The case brought out evidence to show that early in 1939 at a duly called special meeting of the Borough of Rankin Council, the proposal of Angelotti was accepted and by virtue of this authorization he furnished "all engineering services and did prepare all the engineering data, plans, specifications required by and in form acceptable to the Works Progress Administration, for such project or projects as were designated by the Council of the Borough of Rankin, and did submit the same to the Allegheny County Branch Office of the Works Progress Administration."

The plaintiff received a total of $4,000 as advance payment and upon conclusion of the work endeavored to collect the balance of the estimated bill of approximately $11,000. Refusal of the new council resulted in the suit. The verdict of the lower court was in favor of paying the full amount.

Upon appeal it was held that the manner he pursued to compel payment by mandamus was improper and, further, that he was not entitled to recover any sum whatsoever because he had failed to comply with the borough code of 1915 which, although it did not require advertising or bidding for such contracts, did not exempt this contract from the necessity of being in writing. The court cited a similar case where it had been held that a borough could not be charged with contractual liability pursuant to ordinance or resolution awarding contract unless the contract was reduced to writing and executed by the parties, even though the ordinance or resolution was reduced to written or typewritten form in the minutes of the council or in the borough's ordinance book.

The case is recorded legally as Angelotti v. Rankin Borough, 341 PA. 320 (1941).

Developing Data for the Design Office

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***Contents in Brief**—Proper classification, presentation, and cataloging of design office data can make for considerable saving of time and money. Such work will not only avoid unnecessary duplication, but it will also make available to all the staff data gathered by individual members. In addition errors, confusion, and extra work can be avoided.*

BECAUSE OF faulty presentation and arrangement and lack of an index, the greatest usefulness of the constantly increasing data of a design office is seldom realized. These data should be among the most important tools of the design force, but often their value is reduced because they are not easily available without loss of time to the old-timer and newcomer alike. Also, too frequently specific information is assembled by an individual for his own use and then, when its usefulness is realized, it is distributed to others in the office before being revised to a standard form and coordinated with data already available. As a result the man who collected the information is continually being bothered by men wanting to know the source of the information, its limits, and details as to its use. To avoid this and many other costly troubles, much time can well be spent when new information becomes available in determining: (1) its exact content, (2) how to coordinate it with existing data, and (3) the best method for recording it for the use of others.

Broadly speaking office data fall into four classifications: estimating, design, construction, and cost. These form a complete circle, and it is by constant attention to completeness of this circle that progress is made in advancing the engineer's art. Generally the classification is not difficult, but, once the classification is decided, the circle should be kept intact by listing all material in a general index covering all four classifications.

Coordination of the new data with that existing calls for a study as to whether the new material is to be used for correcting old charts and tables, merely added as new charts or tables of existing data, or classified under an entirely new head.

Presentation of data

Presentation is one of the most important steps, and several factors should be observed.

First, all sheets should be standard size and proportioned to fit into standard and easily-obtained binders.

Second, the pages should have sufficient margin to prevent having to take the binders apart to see the data nearest the bound edge. Also, proper margins on the other edges will obviate the loss of data from dog-earing.

Third, each individual sheet, or the first of a series, should include all facts relating to the source of the data, the assumptions involved, the relations represented, the units in which results are given, and all other pertinent information.

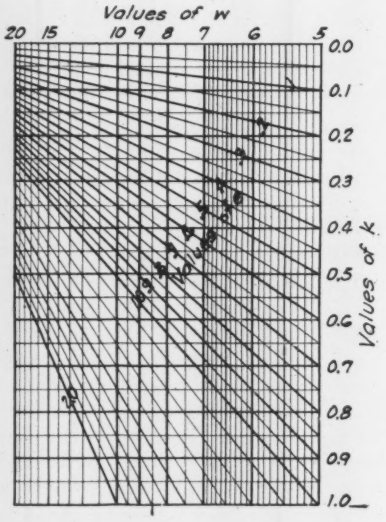

Fig. 1. Good example of using uniform graduations along one axis and non-uniform along other to make family of curves a series of concurrent straight lines.

Fourth, in presenting data graphically it is important that with similar sheets the smallest division of the coordinates on each sheet represent the same unit. This avoids mistakes and backtracking when using several sheets simultaneously. In any case the largest division of coordinates should represent unity times some positive or negative integral power of ten. Frequently printed coordinate sheets fulfilling all the various demands are not available, but data worth presenting are worth the cost of preparing the required sheets.

Fifth, proper choice of the graph, chart, or nomograph calls for considerable study. This is of so much importance that it will be discussed in detail.

Preparation of charts

Probably the majority of engineering data sheets presenting calculated numerical data are given in the form of graphs on rectangular coordinates, with the relation between two variables presenting a single curve and the relation between three appearing as a family of curves. The advantages of a coordinate presentation are manifest; the method fails only when an attempt is made to push it beyond its natural limits.

One of the most frequent failures is presenting a relation with uniform graduations that can more successfully be shown with non-uniform scales. If the relationship is in the form of a curve it is necessary to calculate several points for plotting. Likewise in showing a family of similar curves the accuracy and usefulness may be lost at one end of the chart because of the inability to estimate the coordinates or because of overlapping and convergence of the curves.

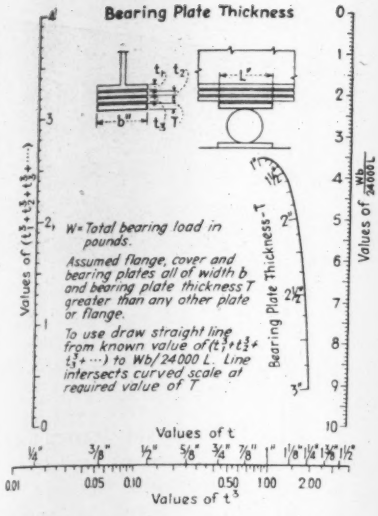
Bearing Plate Thickness
W = Total bearing load in pounds.
Assumed flange, cover and bearing plates all of width b and bearing plate thickness T greater than any other plate or flange.
To use draw straight line from known value of ... to Wb/24000 L. Line intersects curved scale at required value of T
Values of t
Values of t³
Bearing Plate Thickness - T
Values of WbT/24000L

Fig. 2. This is a splendid illustration of nomograph using two straight lines and one curved line for graphical solution of cubic equations.

If the relation is logarithmic and logarithmic coordinates are used for plotting, these disadvantages are not only overcome, but the curves become straight lines and only two points for each line are needed for plotting. Besides ease of plotting there is increased accuracy, since the accuracy for small values of the independent variable is as great as for large values.

In the same way the difficulty in plotting and reading a family of hyperbolas or curves of a like nature may be overcome by so choosing graduations along both axes that the curves become a family of parallel straight lines. Another type of graph for such a system of curves uses uniform graduations along one axis and non-uniform on the other, resulting in the family of curves becoming a series of concurrent straight lines. Such a graph is shown in Fig. 1, which represents the formula

$$W=\frac{6e\,(N_L-1)}{K\,(N_L+1)} \quad \text{for } N_L=11.$$

This particular chart was to be used in conjunction with two other adjacent curves so that it was desirable that the "k" scale consist of uniform graduations and that the family of curves be straight lines.

Another disadvantage of the rectangular coordinate system is the difficulty of presenting on one sheet the relationship between more than three variables. For example for showing the relation between four variables the common practice is to give one of the variables a constant value for one sheet, another value for a second sheet, and so on until this variable has been covered. But this results in a multiplicity of sheets, and prevents presentation of many relations that would be of considerable value in the design office.

Nomograph very useful

In such a case the nomograph or alignment chart, which deserves to be used more than it is, is a very useful method of presentation. In its usual form this type of chart consists of three or more straight or curved scales, each scale being marked with the values of one variable. A straightedge held across the scales will intersect them at values satisfying the equation for which the nomograph was designed. Thus the relation between three variables may be shown on one sheet with three scales, as compared to a family of curves with rectangular coordinates. However, nomographs have one big disadvantage in that the equation showing the relationship between the three variables must be known, at least in its general form, before the nomograph can be designed. Nevertheless, the nomograph in most cases has so many advantages that it deserves the utmost consideration.

The nomograph has one of its greatest uses in the tedious and laborious solution of specific quadratic and cubic equations. One type of nomograph used to solve cubic equations consists of one curved and two straight scales. A splendid example of this use is Fig. 2. This nomograph represents the solution to the equation

$$WbT—24{,}000\ LT^3=24{,}000$$
$$L(t^3_1+t^3_2+t^3_3+\ldots\ldots)$$

which is tentatively proposed by Wm. J. MacKay, Illinois division of highways, for determining the thickness of bearing plates on the bottom flange of a built-up I-beam at a roller bearing maximum with stress equal to 18,000 psi.

Another place where the nomograph excels is in presenting the relation between four variables on one sheet. The general form of the cubic equation is an example of this type, and may be shown as two straight scales with a family of curved scales between them. Advantages of such a chart are revealed when comparing it with the several sheets, each showing a family

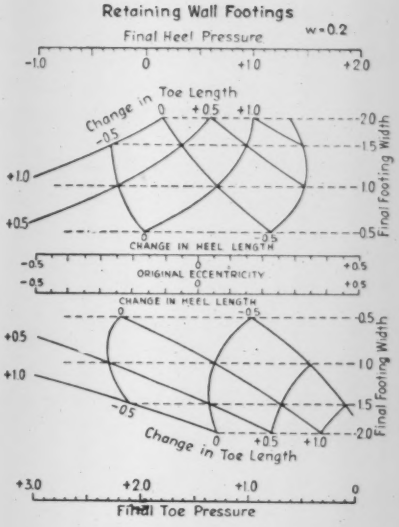

Fig. 3. Presentation of equations involving four variables may be shown on one sheet with two straight scales and a family of curved scales, as shown by the two charts above for designing retaining wall footings.

of curves, required with the ordinary rectangular coordinate solution.

Also some particular types of equations of five variables may be presented on one sheet with one or more straight scales and two families of curved scales. A straightedge placed on these scales is all that is necessary to determine one variable when four are known or to define the corresponding pairs of values of two variables when the other three are known. The advantage of being able to pick off pairs of values of two variables which will satisfy the equation is invaluable in some instances. A good example of this is Fig. 3, which shows the relationship of four variables that must be evaluated in designing retaining wall footings.

Although it may first appear impossible, to complete the job of making design data of the most value, an index must be prepared. The writer has found that an index patterned after the Dewey Decimal System can be made to fit both present and future needs. This index facilitates insertion of new sheets in their proper positions, and groups all similar data. Each sheet is given a drawing number independent of the index number and a date. Then, if a particular sheet has been superseded, a glance at the date and drawing number will determine what sheet to use.

How to Prepare Drawings For Structural Welding

BUILDING DESIGNERS' LIBRARY

LaMotte Grover

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***Contents in Brief**—Standardization of a system of symbols for conveying information on structural welding drawings has been accomplished. Actual welds are not shown (in contrast to the familiar practice of showing rivets), but instead arrows carrying the appropriate symbols point to the joints. Some notes are necessary giving size, lengths and spacing of welds, degree of bevel, etc., but in general arrows and symbols convey the information.*

To Prepare Drawings properly for arc or gas welding, the steel detailer must have a means of accurately conveying complete information about the welding to the shop and erection forces so that this information conforms to the intent of the designer. It is important that the same standard system of weld symbols be used by designing engineers and the drafting departments of all steel fabricating firms if misunderstanding and confusion are to be avoided.

It is assumed herein that the detailer is familiar with general practice in detailing structural steel. Use of the standard welding symbols of the American Welding Society is illustrated for all common applications. Interpretations for less common cases can be found in "Welding Symbols and Instructions for Their Use" revised, approved and issued by the American Welding Society as of October, 1940.

Revision being adopted

This system of designating welds, as revised, has been adopted by a number of large structural steel fabricators, manufacturers of welded machinery, governmental design departments and other principal industries using welding. After six years of careful study in actual use of the symbols, the system of their application and interpretation as to location of welds has now been changed somewhat to overcome difficulties that have been experienced and to conform to practices found satisfactory. Nation-wide acceptance and adoption of the system in its present form seem to be assured.

Those familiar with previous editions will find that the legend for use on drawings specifying arc and gas welding (Fig. 1) remains unchanged, except for the notes and explanation of the significance of "arrow (or near) side" and "other (or far) side" of the joint. The joint, itself, is now the reference for orientation, regardless of whether the symbols appear on cross-sections, end views, plan views or elevation views; and it makes no difference whether the weld is on the near side of a plate, toward the reader, or on the side away from the reader. Although this feature may seem to be somewhat of an innovation to the structural engineer, it has permitted the system in general to be greatly simplified.

The general scheme for designating welds of various types is easily understood from Fig. 1. It is best to avoid use of the terms "near side" and "far side" in speaking of the welds, themselves. A symbol placed below the shaft of the arrow (as viewed from the bottom or right side of the drawing), indicates a weld that is to be made on the side or from the side of the joint adjacent to the head of the arrow that points to the joint. A symbol placed above the shaft of the arrow indicates a weld that is to be made on the side or from the side of the joint opposite to the head of the arrow.

In applying the system to structural parts or members, such as double-angle web members of a truss, or

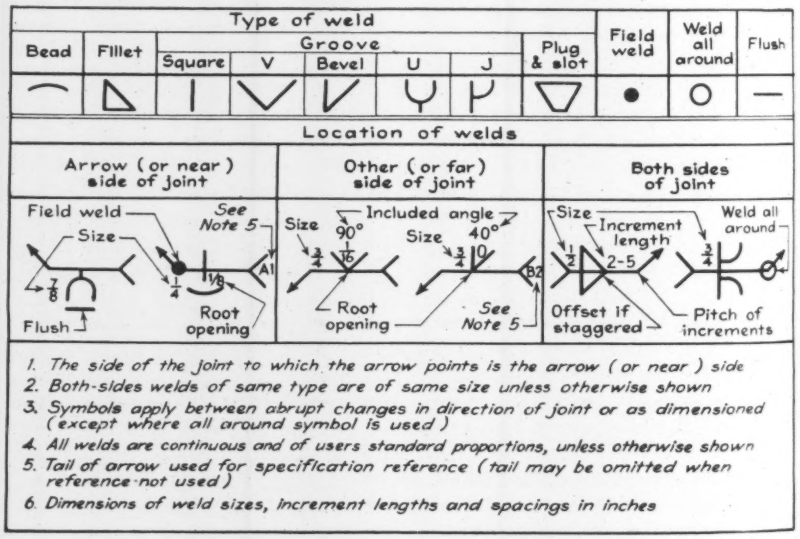

Type of weld
Bead
Fillet
Groove
Square
V
Bevel
U
J
Plug & slot
Field weld
Weld all around
Flush
Location of welds
Arrow (or near) side of joint
Other (or far) side of joint
Both sides of joint
Field weld
Size
See Note 5
Root opening
Flush
Size
Included angle
Root opening
See Note 5
Size
Increment length
Weld all around
Offset if staggered
Pitch of increments
1. The side of the joint to which the arrow points is the arrow (or near) side
2. Both-sides welds of same type are of same size unless otherwise shown
3. Symbols apply between abrupt changes in direction of joint or as dimensioned (except where all around symbol is used)
4. All welds are continuous and of users standard proportions, unless otherwise shown
5. Tail of arrow used for specification reference (tail may be omitted when reference not used)
6. Dimensions of weld sizes, increment lengths and spacings in inches

Fig. 1. Legend for use on drawings specifying arc and gas welding.

girder web-stiffener-bars, matched opposite each other, the detailer will usually find it possible and convenient to include a note on the drawing, such as "All stiffeners (or angle connections) on far side of web to be welded same as those on near side, unless otherwise noted." (Fig. 3). This, together with the marking and billing of the parts as two bars or two angles of a given size or designation, will adequately cover the details on the far side of the member in most cases. If the welding is different for the hidden member, a section view is usually required for other reasons, as well as to show the difference in welding.

In Fig. 2 the use of the symbols in cross-section or end views is illustrated for various types of joints, and the significance of each symbol is illustrated by showing the welds, themselves. In practice the symbols, alone, are entirely adequate, provided care is exercised in cases like Fig. 2 (g) and (h) to indicate clearly the part to be grooved, in the manner illustrated.

An example (Fig. 3) taken from the American Welding Society Specifications for Welded Railway and Highway Bridges, Edition of 1941, illustrates a typical application of the symbols to an elevation or plan view. Dimensions of the members have been omitted for the sake of simplicity.

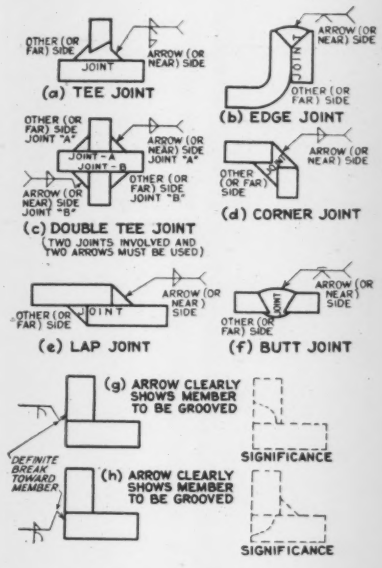


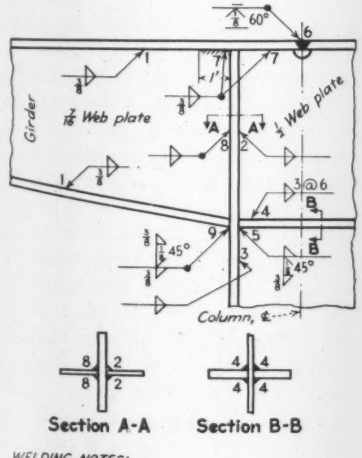
Fig. 2. Use of symbols for various types of joints, and their significance. In practice, the welds, themselves, need not be shown as in (a) to (f), but only the symbols as in (g) and (h). For joints (a) to (f), inclusive, the arrow would point directly toward the line of the joint. For joints (g) and (h), it must be reflected toward the member to be grooved, to avoid ambiguity.

The details have been chosen to illustrate a large variety of applications of the welding symbols rather than to depict best design practices in all respects. The rather extensive notes in the table accompanying Fig. 3 indicate the large amount of information that is adequately represented by ideographic symbols of this kind.

The symbols, interrupted in conjunction with standards of design and a standard procedure of welding, such as those incorporated in the revised welded bridge specifications and building code of the American Welding Society, convey complete information to the shop regarding the preparation of edges for welding and the manner in which the welds are to be made. Unless some departure is to be made from the design and procedure standards of the specifications for the work, the figures for included angle of groove and for root opening may be omitted from the symbols for butt welds. The size of butt welds is assumed to be the full thickness of the material unless a lesser dimension is shown to indicate an incomplete penetration weld.

A sheet of job standards can be furnished to the shop, based upon the specifications, to cover dimensions of weld grooves not shown, as well as other welding procedure data. In any event, certain items like radii for U- and J-grooves, and root-face dimensions must be covered separately by job or shop standards based on the specifications.

When a rather extensive change is



1. Continuous shop fillet welds, 3/8 in., both sides of 7/16-in. girder web plate to flange plate, except where dimensioned.
2. Continuous shop fillet welds, 5/16 in., both sides of 1/2-in. column web plate to column flange plate, above horizontal stiffeners.
3. Same as 2, below stiffeners.
4. Intermittent shop fillet welds, 5/16 in., 3 in. long, 6 in. center to center, both sides of stiffeners to 1/2-in. column web plate.
5. Shop butt welds, stiffeners to column flange plate; 45° single bevel with 1/8-in. root opening, groove opening downward, 5/16-in. reinforcing fillet above stiffener and 3/8-in. reinforcing fillet below stiffener.
6. Field butt weld between girder flange plates; 60° single V, 1/8-in. root opening, root gouged and re-welded, and both faces flush, but not finished.
7. Continuous field fillet welds, 3/8 in., both sides of girder and column web plates to girder flange plate.
8. Continuous field fillet welds, 5/16 in., both sides of 7/16-in. girder web plate to column flange plate.
9. Field butt weld, girder flange plate to column flange plate; 45° single bevel, 1/8-in. root opening, groove opening upward, 3/8-in. reinforcing fillet above and below girder flange plate.

Fig. 3. How to use welding symbols on a structural drawing. Explanation of each numbered symbol is given at the right.

desired from the ordinary standards of design and welding procedure, necessitating reference to a special provision, a tail is added to the arrow and the reference number or letter is placed in this tail. (Fig. 1).

The size of all welds must be shown in the appropriate position (Fig. 1), unless a general note covers this as in Fig. 3. Also the length of the welds must be shown unless they are continuous between abrupt changes in direction of joint or between intervening details that break the continuity; and unless the length of weld is shown by dimension lines as for weld No. 7 of Fig. 3. Of course, when the "weld all around" designation is added to the symbol, no length need be shown.

It will be observed that the symbol for a fillet, bevel, or j-type weld is always drawn with the perpendicular leg to the left regardless of whether the base arrow points to left or right. Most drafting departments prefer to draw the symbols at least partly guided by a small templet, rather than free hand.

All dimensions of welds are understood to be in inches and degrees of angle, and the inch or degree marks may be omitted. When unequal leg fillet welds are used, as $\frac{1}{4} \times \frac{5}{8}$, the two dimensions for size are shown, enclosed in parentheses, in the customary position to the left of the fillet weld symbol. If it is not evident, the position of the legs relative to the members is shown on the drawing.

The pitch of intermittent fillet welds is always measured between centers of increments on one side of the joint, regardless of whether there are matched or staggered increments on the opposite side. An increment, rather than a space, is always assumed to be at the end of an intermittent weld.

Only filled or partly filled plug and slot welds are indicated by the symbol shown in Fig. 1 for such welds. Fillet welds in holes and slots are indicated by the proper fillet weld symbols.

Faces of welds are assumed not to be finished, other than cleaned, unless a special finish mark (whatever may be the shop's customary notation) is added just outside the flush symbol illustrated in Fig. 1. Such finish marks, as to method and degree of finishing, have not yet been standardized by any authoritative body. The flush symbol, without a finish mark, indicates welding is to be done from that side of a joint with a minimum amount of surface convexity, usually specified in the applicable standards.

When the use of the welding symbols is first being started in a plant, the shop personnel should be carefully instructed in the interpretation of certain features such as the fact that the standard weld symbols for groove welds (butt welds) imply the bevelling or machining (by frame or tools) of plate edges to prepare them for welding, and the fact that this work must be done accurately and usually to quite close over-all length tolerances. Most of the workmen are likely to be unaccustomed to this means of conveying information.

Inaccuracies that may occur, due to misunderstanding or carelessness in interpreting the instructions of the engineering department, will likely result in poor fit-up during assembly or erection, which increases the cost of welding a great deal and sometimes calls for expensive corrections. From this, it is evident that a universally adopted system for conveying exact information to the shop is of paramount importance.

War Road Problems in Shanghai

SOME OF THE PROBLEMS faced by engineers who must carry on their operations under the conditions imposed by the war in China are outlined by A. F. Gimson, commissioner of public works, Shanghai, in his annual report for the year 1940. The following comment on road maintenance problems indicates that the experience is not entirely without its compensations.

"The excessive concentrations of heavy traffic on the roads of the central and western districts [of Shanhai] which began to be felt in 1938 have continued to absorb much of the attention of the department. The iron-tyred trolleys which are responsible for so much of the damage done to road surfaces increased in numbers during the year to more than 20,000.

"The most important feature of the year has been the perfecting of a technique developed by the department in recent years for making and repairing roads independently of supplies of the basic road-making materials, broken stone and sand. In normal times nearly 100,000 tons of these materials were purchased annually. Only very small amounts were obtainable in 1938 and 1939 and no supplies of any consequence were received in 1940, everything of the kind having to be extracted from the existing roads.

"Where a road is now due for extensive repairs or reconstruction, all the materials forming it are removed. The granite blocks from the foundations provide, after crushing, the different sizes of broken stone and the sand needed for the construction of a concrete road. This road, as it is now made on a base of cement-bound cinders, only requires about one-third of the materials obtained from the foundation of the former road, the remainder providing a stock available for other work. Similarly, the materials extracted from the road surface after washing, screening and sometimes crushing provide all the hard and bulky ingredients needed for making the dozen or more different types of wearing surface used locally.

"In such a congested area as the Settlement where it is not practicable, as it is in other big cities, to close the main roads for repairs, and where largely owing to the great number of excavations made by the public utilities repairs are going on at more than 100 places at a time, it becomes difficult to insure that all the many different technical processes used in road making are reliably carried out. This difficulty is increased when the processes to which all the foremen and workers have grown accustomed are changed. The special attention which has had to be given to this aspect of the physical work on the road has been so successful that the new processes are now being more reliably carried out than those regularly used for so many years, with the result that the roads as now constructed with materials salvaged from worn-out roads have better wearing qualities than those made when unlimited materials were available."

From Field and Office

Working problems and time-saving methods for engineers and contractors

Intercepts on Skewed Piers

Finding distances along the center line, on skewed bents on horizontal curves, is made quick and easy by the method shown by the accompanying diagram and calculation, As diagrammed the problem is: Given a bridge on a horizontal curve of radius R supported on bents skewed Θ deg. with radial lines and having widths w curb to curb and s c to c of handrails. Required: intercept distances $a\ b$; $b\ c$; $c\ d$, and $d\ e$ of the given arcs on the center line of bent. Draw the radial line $O\ Y$ and on it mark center of roadway c, curb lines b_1 and d_1 and center lines of handrails a_1 and e_1. Draw arcs through these points intersecting center line of bent at a, b, c, d and e; draw radii to these points; extend center line of bent and draw $O\ X$ perpendicular to it. Now $O\ X = R \sin \Theta$ and $cX = R \cos \Theta$. And

$$aX = \sqrt{\left(R - \frac{s}{2}\right)^2 - (O\,X)^2}$$

$$bX = \sqrt{\left(R - \frac{w}{2}\right)^2 - (O\,X)^2}$$

$$dX = \sqrt{\left(R + \frac{w}{2}\right)^2 - (O\,X)^2}$$

$$eX = \sqrt{\left(R + \frac{s}{2}\right)^2 - (O\,X)^2}$$

With these values it follows that $ab = bX - aX$; $bc = CX - bX$; $cd = dX - cX$; $de = eX - dX$.

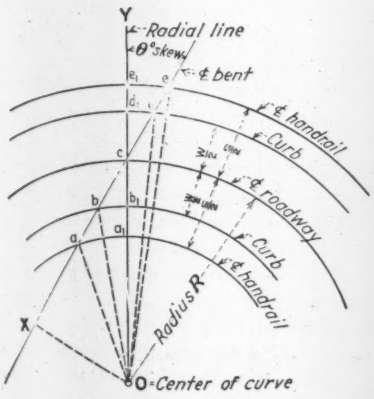
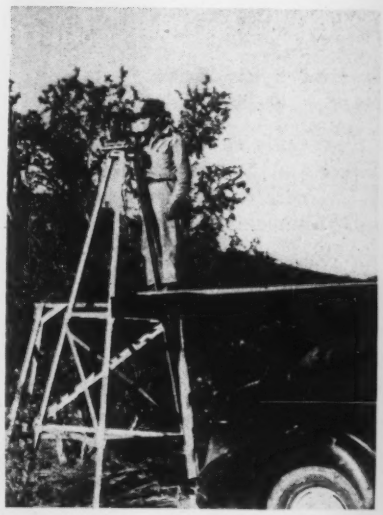


Diagram for computing intercepts on skew piers.

Other solutions require dealing with functions of the central angle, which is always so small that an unreasonable degree of accuracy is required interpolation when logarithms are used, or in case natural functions are used, the function must be accurate to ten or even twelve decimal places.—HUNTER H. JOHNSON, *Assistant Engineer, Alabama Highway Department, Montgomery, Ala.*

Portable Instrument Tower

In the accompanying photograph is shown a portable instrument tower designed and constructed by the Phoenix

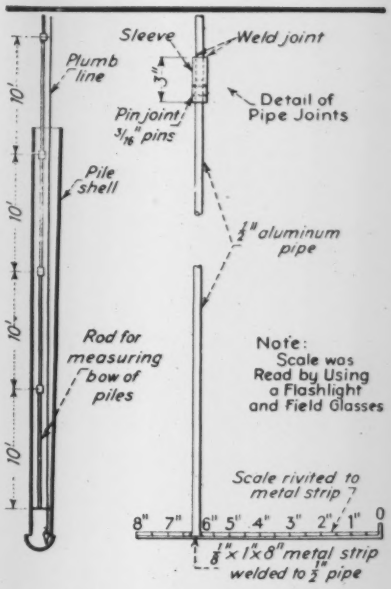


Portable instrument tower saves much brush-cutting.

office of the U. S. Bureau of Reclamation. It is now being used by survey crews laying out a route for the proposed Colorado River-Central Arizona aqueduct (*ENR*, Sept. 5, 1940, p. 315). Bureau officials believe considerable brush-cutting is saved by the structure.

The tower, which stands 12 ft. high, is operated from a platform bolted atop a government car as shown. When the instrument is used at points to which the car cannot be driven, the portable platform shown behind the tower is used.

Constructed of 2x2's braced with 1x2's, the tower can be carried without difficulty by two men over rugged terrain or lashed atop the car with the platform can be fastened to the rear bumper.—ROBERT K. MAUD, *Phoenix, Ariz.*

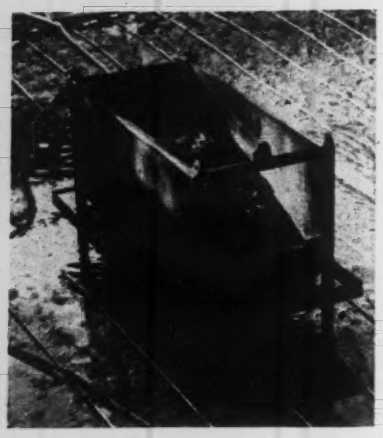

Sleeve
Weld joint
Plumb line
3"
Detail of Pipe Joints
Pin joint 3/16" pins
Pile shell
1" aluminum pipe
Rod for measuring bow of piles
Note: Scale was Read by Using a Flashlight and Field Glasses
Scale rivited to metal strip
8" 7" 6" 5" 4" 3" 2" 1" 0
1" x 1" x 8" metal strip welded to 1" pipe

SHELLS driven for piles on a river control job in Hartford, Conn., tended to be pushed out of plumb by soft muck. To determine the true location of the tip and amount of "bow" in the pipe, the U.S. Engineers devised the lightweight rod, with scale at its lower end, shown here. The scale is read with field glasses, assisted by light from a flashlight, with the readings revealing the distance at 10-ft. or smaller intervals from the side of the pile to a plumb line.—T. R. SMITH, U.S. Engineers Office, Hartford, Conn.

Insulated Trash Burner Simplifies Dam Cleanup

Trash burners made on the job at Friant Dam in California have a supporting frame made of old pipes with a sheet-metal box and an insulating layer of water beneath to avoid damage to concrete. When one of these burners is set down by the derrick in a block to be cleaned, waste lumber and other inflammable refuse is thrown into it by workmen, thus avoiding the necessity for carrying out the trash in skips and eventually burning it elsewhere.

The vertical posts at the four corners of the burner are 4-in. pipe and



Trash burner at Friant Dam makes it unnecessary to use a skip to haul out waste lumber.

have their tops flattened and drilled to receive clevises of the sling used to lift it. The fire box is about 5x10 ft. in plan, sides and bottom are made of $\frac{5}{16}$-in. steel plate and the cross-pipes are 2 in. in dia. Below the fire box a water tray, providing for a 6-in. depth of water, extends 1 ft. past the outer edges of the box. Below this water tray the legs are made about 20 in. long to afford room for sand-blasting and sluicing operations that it might be desirable to carry on without moving the burner.

Backhoe Digs Sub-basement

In preparation for a 4-story addition to the F. W. Woolworth & Co. store in Detroit the excavation subcontractor put a ½-yd. backhoe on the original basement floor and dug out on additional 15-ft. depth for a new sub-basement. The addition covers an area 60x100 ft., and the presence of an old brick building on the opposite side of the lot complicated the excavation work. It was necessary to underpin this old building, and then brace its exposed wall with light wooden trusses spanning the lot transversely.

Though the trusses were set high enough above the original basement floor in the addition area to clear the shovel, they acted as a barrier to any other method of excavation. Spoil was loaded directly into trucks at basement level. The trucks entered and left the hole over a timber ramp connecting the basement with an alley to the rear.

The store addition is under the direction of Hyde & Williams, Architects, Detroit. Barton-Malow Co., Detroit, is general contractor, and Chas. J. Rogers, Detroit, is subcontractor on the excavation work.

Wetted Brick Make Tighter Walls

Tests on brick walls at the National Bureau of Standards, Washington, D. C., indicate that increased watertightness is obtained when the suction rate of absorptive bricks has been reduced by wetting prior to placing, and when all the joints are well filled with mortar having good working properties. Walls when subjected to conditions simulating exposure to wind-driven rain were found to show great differences in their resistance to water penetration. Some leaked badly in less than 3 min., while others stood a severe test for five days. When leakage occurred, it took place largely through openings in the joints, and the condition of the joints depended mostly upon the method of laying the units. The walls that were most resistant either were built with solidly filled vertical joints, or were protected by a moisture barrier consisting of a plaster coating of mortar within the wall.

The watertightness of joints also was affected by the suction rate (water absorbed when part immersed for one minute) of the bricks at the time of laying, and the working properties or water retentivity of the mortar. In general, it was found necessary to wet highly-absorptive bricks before they were laid to obtain masonry with a good resistance to rain penetration; in fact, the wetter the bricks at the time of laying the greater the resistance. Tooling the face joints assisted slightly in reducing the leakage, but the permeability was governed largely by the quality of the joints in the interior of the walls.

Reducing the number of header bricks in walls of common American bond did not have a significant effect upon the water permeability. Walls composed of a facing of low-absorptive brick and a backing of highly-absorptive brick gave better performances than similar walls constructed entirely of either type of brick. Walls of structural clay tile or hollow concrete block were not highly resistant to rain penetration unless provided with a facing, such as brick masonry or portland cement stucco, or a coating of cement-water paint applied by stiff brushes. The performance of cavity walls containing a 2-in. air space indicated that such walls, when properly flashed, would provide an adequate barrier against water penetration.

Openings in the joints of existing brick walls were sealed satisfactorily by: (1) raking out the joints to a depth of at least ½ in. and repointing; (2) scrubbing a 1:1 grout of portland cement and fine sand into the joints by small stiff brushes, and (3) applying two coats of cement-water paint, using stiff fiber brushes. Application of thin waterproofings retarded the transmission by capillarity of water through the brick but did not seal the relatively large openings in the joints.

Bay City Shovels, Inc., photo

Backhoe in basement deepens the hole for a Detroit building addition.

Book Notes and Reviews

The month's addition to the engineer's reading and reference list

Better Concrete Inspection

A.C.I. MANUAL OF CONCRETE INSPECTION—Published by the American Concrete Institute, 7400 Second Blvd., Detroit, Mich. Price $1.

Great stress on the importance of his job and little actual advice and help on how to improve it have long been the lot of the construction inspector. Recognition of this state of malnutrition, in so far as concrete inspectors are concerned, led a committee of the American Concrete Institute to prepare this manual which, for a first attempt, should excite the admiration of every engineer and contractor. Written by J. W. Kelly, of the University of California, and criticized and edited by ten prominent concrete practitioners, it is as authoritative as it is useful. What are an inspector's responsibilities? How are materials inspected and tested? What methods of proportioning are good practice? How is inspection handled before, during and after concreting? How is concrete tested? What records and reports should be made? The answers to these and many other questions are given in the book.

Managing a City

MUNICIPAL MANAGEMENT — By Thomas Harrison Reed. 665 pp. McGraw-Hill Book Co., New York and London. Price, $4.

Aspirants to, or occupiers of, the role of city manager, public works director, or even lesser administrative posts in local governments, will want this book on their reference shelf once they have seen it. Practical and concise, it covers every phase of public administration from relations between executive and council to graft and corruptions in public works specifications and contracts.

Neither figuratively nor literally, however, is this a treatise on municipal housekeeping. This book does not tell how to pave a road or clean a street, but addresses itself to the broad problems of organization and administrative practice. Basic administrative relationships, fundamentals of municipal finance, selection and training of personnel and management of operating services are the matters that are scrutinized and discussed.

The author, Thomas H. Reed, is a seasoned participant in municipal politics, an experienced city executive and a technical consultant to many local governments. Wise in the ways of public administration, he imparts this wisdom in the manner of a kindly counselor.

Aid for Surveyors

MANUAL OF RECONNAISSANCE FOR TRIANGULATION — Special Publication No. 225, U. S. Coast and Geodetic Survey. Supt. of Documents, Washington, D. C. Price 15c.

CONTROL LEVELING—Special Publication No. 226, U. S. Coast and Geodetic Survey. Supt. of Documents, Washington, D. C. Price 5c.

HORIZONTAL CONTROL DATA—Special Publication No. 227, U. S. Coast and Geodetic Survey. Supt. of Documents, Washington, D. C. Price 10c.

Three new publications of the U. S. Coast and Geodetic Survey that will be of help to engineers engaged in exact land surveying operations have been announced by Rear Admiral Leo Otis Colbert, director.

Manual of Reconnaissance for Triangulation was prepared primarily for use of engineers of the U. S. Coast and Geodetic Survey but should prove helpful to other engineers who have occasion to plan triangulation surveys. It explains the most desirable types of triangulation figures, how to locate stations where they can be made intervisible with the minimum amount of tower building, how to take account of the earth's curvature and refraction, how to test the intervisibility of stations by indirect methods, and other matters having to do with successful reconnaissance surveys.

Control Leveling was prepared primarily to promote a better understanding of the principal uses and value of the many thousands of benchmarks now widely scattered over the United States. It describes briefly the field methods and instrumental equipment used in determining the elevation of these benchmarks and how the data are made consistent by office processes. Also given is a brief history of the determination and adjustment of the net of level lines over the country.

Horizontal Control Data attempts to give in a few pages a general picture of the methods used in surveying large areas of the curved surface of the earth by means of triangulation, and to explain how the resulting data are reduced to geographic positions and plane coordinates in a form readily usable by surveyors and engineers.

Railway Situation Studied

THE RAILROAD PROBLEM AND ITS SOLUTION—By John E. Muhlfeld. 289 pp. Published by Devin-Adair Co., New York. Price, $3.

In its numerous and varied aspects, the railroad problem as a whole is well presented in this book. It is pointed out that in spite of highways, automobiles, motor trucks, airways and inland waterways, the railways must still be depended upon for the handling of two-thirds of the total national transportation of passengers, freight, mail and express. Mr. Muhlfeld is strongly opposed to government ownership of the railway system, and also to enforced government management in the emergency of war conditions.

But as to the solution of the complicated railroad problem, the propositions set forth are unconvincing. In a series of eight chapters Mr. Muhlfeld presents an almost endless list of general and detail measures and actions that, in his opinion, should be initiated and carried out by the railroads themselves, the federal and state governments, the Interstate Commerce Commission, the Reconstruction Finance Corporation, labor organizations, the traveling and shipping public, the railway equipment and supply manufacturers, and the railroad investors. Since many of the proposed developments interlock and involve cooperation of various parties of interest, the general result involves such multitudinous considerations as to make the whole scheme appear impracticable. Mr. Muhlfeld, however, sidesteps this difficulty by suggesting as a slogan "It can be done".

As an exposition of the railway

situation, the book is highly interesting and instructive. As a step towards the solution of the railroad problem, it lacks force and practical appeal.

Air-Raid Defense

AIR RAID DEFENSE (CIVILIAN)—By Curt Wachtel. 240 pp. Chemical Publishing Co., Brooklyn, N. Y. Price $3.50.

AIR RAID PRECAUTIONS—Reprint of official British publications. 287 pp. Chemical Publishing Co., Brooklyn, N. Y. Price $3.

These two books have been published to meet popular demand for information on air-raid defense. Such information was not easily available in this country until the publication of *Civil Air Defense* and *Protective Construction* this spring (*ENR*, May 22, p. 844). These new books make available additional material relating to defense against air attack. The first is written by a refugee authority on chemical warfare. It is addressed to civilians rather than engineers and reports briefly on European experience in defense against air raids, especially on community organization to protect life and property. The structural aspects of air defense are treated in one short chapter.

The second book, *Air Raid Precautions*, is a reprint of ten pamphlets put out by the British Government. The largest chapter, structural defense, contains basic knowledge required for an understanding of the structural problems involved in combatting the effects of bombing. It should be noted, however, that much of this information is outdated by the high-powered bombs now in use, bombs that were not in use when this information was collected.

Engineering Records

THE PICKWICK LANDING PROJECT and THE GUNTERSVILLE PROJECT—Published by the Tennessee Valley Authority, Technical Reports 3 and 4. May be obtained from the Supt. of Documents, Washington, D. C. at $1 each.

Most engineers who participate in the construction of a large engineering project occasionally indulge in what generally turns out to be wishful thinking as to the advantages of a carefully written record of the job, its problems and how they were met. Few ever see their hopes come to fruition. The exceptions are found chiefly in a limited number of governmental operations where time and money is available for such a summing-up.

The two Tennessee Valley Authority reports here noted are among those exceptions. Two earlier reports of similar character covered the Norris project and Wheeler Dam. Because of the high quality of the engineering applied to the design of these projects and to the construction plant and construction operations, these records should prove to be of great value to engineers and contractors of the future because of the completeness with which all operations from the preliminary planning and exploration of the site to the placing of the last steel are set forth.

Miscellaneous Notes on Booklets and Reprints

STUDIES IN THE REINFORCEMENT OF CONCRETE with rattan and bamboo, and reinforcing pressed brick and soft brick with steel, carried out at Tientsin University, of Tientsin, China, are reported in the July, 1941, bulletin of the faculty of engineering. The major part of the bulletin is in English.

MANUFACTURERS and others having equipment or materials to sell to the government in these times of rapid changes in government offices will find information of value in *How to Sell to the Government for Civilian Needs*, a pamphlet just published by the U. S. Department of Commerce as Industrial Series No. 2.

VOCATIONAL GUIDANCE INFORMATION of value to the many engineers now helping in such work is found in *Vocational and Professional Monograph No. 14—Engineering*, by Prof. Richard H. Smith, Massachusetts Institute of Technology. Copies may be obtained from the Bellman Publishing Co., 6 Park St., Boston, Mass. Price, 75 cents.

A DESIGNER'S TOOLS is the author's characterization of a small pamphlet which attempts to lessen the "pedantic atmosphere" that usually surrounds the terms shear, moment, slope deflection, radius of gyration, modulus of elasticity, section modulus and moment of inertia in most texts, making them live physical concepts rather than dead symbols. Copies may be obtained from William Popper, 5408 U St., Sacramento, Calif., for $1.

New Engineering Books

SUBDIVISION REGULATIONS—By Harold W. Lautner. 346 pp. Published by the Public Administration Service, Chicago.

BLUEPRINT READING AND SKETCHING—By H. R. Thayer. 141 pp. McGraw-Hill Book Co., New York and London. Price $2.

STRENGTH OF MATERIALS-Part II. Advanced Theory and Problems—By S. Timoshenko. Second Edition. 509 pp. D. Van Nostrand Co., Inc. 250 Fourth Ave., New York. Price $4.50.

DESIGN OF MODERN STEEL STRUCTURES—By Linton E. Grinter. 452 pp. The Macmillan Co., 60 Fifth Ave., New York. Price $5.

PNEUMOCONIOSIS (SILICOSIS)—By Lewis Gregory Cole and William Gregory Cole. Published by the John B. Pierce Foundation, 40 West 40th St., New York. Price on application.

SIXTY-YEAR INDEX—A.S.M.E. Technical Papers 1880–1939. 189 pp. Published by The American Society of Mechanical Engineers, 29 West 39th St., New York. Price $3.75.

TRANE AIR CONDITIONING MANUAL—376 pp. Published by The Trane Co., LaCrosse, Wis. Price, $5, with charts and estimating sheets.

ARCHITECTURAL GRAPHIC STANDARDS—By C. G. Ramsey and H. R. Sleeper. Third Edition. 344 pp. John Wiley & Sons, Inc., New York; Chapman & Hall, Ltd., London. Price $6.

EXPERIMENTS UPON THE FLOW OF WATER IN PIPES AND PIPE FITTINGS—By the late John R. Freeman. 349 pp. Published by The American Society of Mechanical Engineers, 29 West 39th St., New York. Price $8.

Reports and Pamphlets

ABSTRACTS OF SELECTED THESES ON SOIL MECHANICS—Serial 79. Dept. of Civil and Sanitary Engineering, Massachusetts Institute of Technology, Cambridge, Mass.

A SHORT WAR THROUGH AMERICAN INDUSTRIAL SUPERIORITY—By Louis Marlio. The Brookings Institution, Washington, D. C. Price 25c.

(*Continued on p. 80*)

Wheel Bearing Lube that Stays *on* the Rollers and *off* the Brakes!

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TUNE IN: "Treasury Hour—Millions for Defense." All-Star Radio Program. Every Wednesday Night, CBS. 9:00 E.D.T., 8:00 E.S.T.; 8:00 C.D.T., 7:00 C.S.T.; 6:00 M.S.T.; 5:00 P.S.T.

TEXACO

TEXACO Lubricants and Fuels
FOR ALL CONTRACTORS' EQUIPMENT

CONTRACT UNIT PRICES

What contractors are bidding on different kinds of construction work

ANDERSON RANCH DAM AND POWER PLANT, IDAHO

OWNER: Bureau of Reclamation, Boise, Idaho.

PROJECT: Construction of Anderson Ranch Dam, an earth dam across South Fork of Boise River; outlet works through left abutment; and open-channel spillway at left abutment. Dam approximately 1,350-ft. long, maximum height 330-ft. above river bed. Main body of dam to be of moistened and rolled embankment of clay, sand and gravel. Power plant, on left bank at downstream toe of dam, to be of reinforced concrete construction, 70x104-ft., and will house two main generating units and station service equipment. (Spec. No. 965.)

CONDITIONS: Contractor to furnish sand; gravel; rock; rock spalls; structural steel supports, steel lagging, and steel tunnel-liner plates; lumber for temporary tunnel timbering; form materials, except absorptive form lining; oil; wire, wire ties; temporary supports; nails; lumber for permanent wood inserts; water; calking material; wood stops; and all materials required for temporary construction in completing this contract. Government to furnish balance of materials. All work to be completed within 1,670 calendar days. Railroad transportation available to Mountain Home, Idaho, about 20 miles from dam-site. Highway available for trucking to site. Minimum wage rates are: skilled labor, 95c. to $1.25 per hr.; semi-skilled, 62½ to 90c.; common, 62½ to 70c.

BIDS: Three bids were received July 7, 1941 ranging from the contract low of $9,986,203 to $14,367,896.

LIST OF BIDDERS:

1. Morrison-Knudsen Co., Inc., Boise, Idaho; J. F. Shea Co., Inc., Los Angeles, Calif.; Ford J. Twaits Co., Los Angeles; Winston Bros. Co., Los Angeles. $9,986,203
2. W. E. Callahan Constr. Co., Los Angeles, Calif.; Gunther & Shirley Co., Los Angeles, Calif.; Peter Kiewit Sons' Co., Omaha; Nebr.; George W. Condon Co., Omaha, Nebr. 11,816,670
3. Guy F. Atkinson Co., San Francisco, Calif.; George Pollock Co., Sacramento, Calif. 14,367,896

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Diversion, care of river, unwater fndn	L. S.	$117,000.00	$25,000.00	$50,000.00
2. Excav., strip sand and grav. deposit	10,000 c. y.	.23	.25	.35
3. Excav., strip borrow pits	700,000 c. y.	.25	.15	.15
4. Excav., common; spillway above El. 4205.5 and road and parking areas	40,000 c. y.	.90	2.00	3.00
5. Rock excav., as above	225,000 c. y.	.90	2.00	3.00
6. Excav., com.; inlet to outlet wks.	5,000 c. y.	5.00	2.00	6.00
7. Excav., rock; as above	35,000 c. y.	5.00	2.00	6.00
8. Excav., common; outlet to outlet wks., spillway, power plant, below El. 4,205.5 and above El. 3885	200,000 c. y.	.90	2.00	3.00
9. Excav., rock; as above	500,000 c. y.	.90	2.00	3.00
10. Excav., common; spillway, outlet to outlet wks., power plant, below El. 3,885	75,000 c. y.	1.20	2.00	4.00
11. Excav., rock; as above	100,000 c. y.	1.20	2.00	4.00
12. Excavation, all classes, in tunnel	27,000 c. y.	18.00	30.00	15.00
13. Perm. struct. st. tun supports	100,000 lb.	.115	.25	.14
14. Steel tunnel-liner plates; steel lagging	100,000 lb.	.115	.10	.14
15. Excav., all classes; fndn. of dam	1,800,000 c. y.	.65	.70	1.50
16. Excav., common; embank. toe drains	1,100 c. y.	1.10	20.00	4.00
17. Excav., rock; embank. toe drains	1,100 c. y.	5.70	20.00	7.00
18. Excav., all classes; cut-off wall footings	2,300 c. y.	14.00	20.00	18.00
19. Excavation of concrete	250 c. y.	14.00	20.00	20.00
20. Backfill	10,000 c. y.	.90	1.50	1.25
21. Road and parking area surfacing	6,000 c. y.	2.25	2.00	3.00
22. Rubble-masonry wall	300 c. y.	17.00	30.00	15.00
23. Excav., Wilson Flat borrow pit, transport to dam embank	3,700,000 c. y.	.40	.36	.48
24. Excav., Whipple borrow pit; trans	1,800,000 c. y.	.35	.38	.40
25. Excav., Camas Creek borrow pit	140,000 c. y.	.50	.41	.43
26. Excav., Two Mile borrow pit, etc.	1,500,000 c. y.	.43	.39	.42
27. Excav., Anderson Ranch borrow pit	1,800,000 c. y.	.51	.41	.4
28. Earth fill, embankment	7,500,000 c. y.	.10	.17	.1
29. Sand and gravel filter blanket; rock fill, downstream embank. slope	110,000 c. y.	.35	.35	.3
30. Cobble and rock fill, downstream slope of embank	1,900,000 c. y.	.27	.24	.1
31. Riprap, upstream embank. slope	90,000 c. y.	.46	.50	1.2
32. Dumped riprap in spillway chan.	3,000 c. y.	1.10	1.00	1.2
33. 4-in. sew. pipe drains, uncem. joints, embedded in gravel	3,000 l. f.	2.25	2.00	.7
34. 4-in. as above, embed. in porous conc	2,850 l. f.	4.50	3.00	2.5
35. 6-in. pipe, as in item 33	2,500 l. f.	2.75	2.00	1.0
36. 8-in. pipe, as in item 33	4,700 l. f.	3.40	3.00	1.2
37. 12-in. sew. pipe, cemented joints	200 l. f.	6.00	2.00	1.5
38. Porous conc. under spillway gate	50 c. y.	24.00	25.00	25.0
39. Drill weep holes	1,500 l. f.	.65	2.50	1.2
40. Drill line holes for rock excav	80,000 l. f.	.57	.60	.6
41. Core drill 5¼-in. holes to 30-ft	1,000 l. f.	4.80	15.00	10.0
42. Drill 1¾-in. grout holes, to 30-ft.	34,000 l. f.	1.25	2.50	1.7
43. As above, 30 to 50-ft.	11,000 l. f.	1.50	2.50	2.5
44. As above, 50 to 100-ft.	10,000 l. f.	1.80	2.50	2.5
45. As above, 100 to 150-ft.	4,000 l. f.	2.30	2.50	3.0
46. Place grout pipe and fittings	20,000 lb.	.17	.30	.2
47. Pressure grouting	75,000 c. f.	1.40	1.50	2.0
48. Pressure grouting with packers	10,000 c. f.	1.70	2.00	2.5
49. Drill holes for anchor bars and grouting bars in place	17,000 l. f.	.70	1.00	1.0
50. Conc. in embank. footings, cut-off walls	2,300 c. y.	11.50	30.00	12.0
51. Conc.; embank. cut-off walls, except footings	1,500 c. y.	26.00	30.00	27.0
52. Conc.; inlet struct. of outlet works, except trashrack beams and girders	3,700 c. y.	27.00	20.00	22.0
53. Conc. in trashrack beams and girders	900 c. y.	45.00	25.00	60.0
54. Concrete in gate hoist house	150 c. y.	34.00	40.00	50.0
55. Concrete in tunnel lining	7,700 c. y.	24.00	40.00	20.0
56. Conc. in spillway floors; outlet wks.; paving about powerhouse, outlet struct	8,500 c. y.	13.50	15.00	15.0
57. Conc. in spillway gate structure	1,000 c. y.	22.50	30.00	22.0
58. Conc. lining of spillway and outlet wks., except floors	5,000 c. y.	20.00	20.00	21.0
59. Concrete in gravity walls	1,700 c. y.	13.50	15.00	12.5
60. Conc., in outlet struc., except floor, side walls below El. 3,885, beams, deck and second-stage concrete	8,500 c. y.	21.00	20.00	20.0
61. Conc.; beam, deck, outlet str.	1,800 c. y.	29.00	30.00	22.0
62. Second-stage conc. in outlet wks	5,600 c. y.	11.00	10.00	10.0
63. Conc. in tunnel access structure	70 c. y.	27.00	50.00	70.0
64. Conc. in powerhouse substructure	2,300 c. y.	17.00	25.00	16.0
65. Conc. in powerhouse superstr.	1,550 c. y.	36.00	25.00	60.0
66. Second-stage conc. in powerhouse	1,000 c. y.	16.00	15.00	18.0
67. Conc. in parapet and curb walls	600 c. y.	34.00	15.00	25.0
68. Place reinforcement bars	4,700,000 lb.	.02	.03	.02
69. Place metal sealing strips	1,850 l. f.	.60	2.00	1.0
70. Place rubber water stops	1,000 l. f.	.80	2.00	1.0
71. Place elastic joint filler	2,500 s. f.	.25	1.00	.7
72. Construct control joints	175 l. f.	1.20	2.00	2.0
73. Place rubber sleeves on rein. bars	1,250 l. f.	.20	2.00	.7
74. Insulate rein. bars and elec. metal cond.	1,000 ea.	.60	2.00	.7
75. Place asph.-saturated roofing	7,300 s. f.	.40	.50	.2
76. Construct glass block panels	660 s. f.	1.80	4.00	1.0
77. Place membrane waterproofing	100 s. f.	.60	1.00	.5
78. Place cork ceilings	1,750 s. f.	.50	.50	.5
79. Install radial gates	86,000 lb.	.04	.025	.0
80. Inst. bulkhead-gate frame and track; trashrack-rake & needle-beam guides	135,000 lb.	.035	.015	.1
81. Inst. blkhd.-gate, trashrack rake	240,000 lb.	.035	.035	.0
82. Install trashracks	600,000 lb.	.018	.015	.0
83. Erect str. steel roof framing and hoist head frame	186,000 lb.	.035	.03	.0
84. Inst. gate and trashrack-rake hoists	92,000 lb.	.05	.03	.0
85. Install traveling cranes	146,000 lb.	.035	.015	.0
86. Inst. crane runway and trans-track rails	56,000 lb.	.03	.015	.0
87. Inst. std. pipe, fittings, pipe, valves, under 6-in.	27,500 lb.	.10	.20	.1
88. As above, 6-in. or over	39,000 lb.	.05	.15	.1
89. Install pipe handrails	5,200 lb.	.12	.40	.2
90. Waterproofing outside walls	135 s. y.	.60	4.00	1.0
91. Lightweight conc. in floors	15 c. y.	30.00	50.00	30.0
92. Inst. met. frames for hatchways, manholes, floor plates, grating	13,000 lb.	.06	.20	.1
93. Inst. met. pier noses, armor angles	8,500 lb.	.06	.20	.1
94. Inst. metal accordion doors	1,020 s. f.	.50	3.00	.9
95. Inst. metal swinging doors	260 s. f.	.50	3.00	.9
96. Inst. metal sash windows	650 s. f.	1.10	3.00	.9
97. Inst. met. louvers, exhaust fans	1,200 lb.	.25	.50	.2
98. Const. flex. steel-plate guardrails	500 l. f.	1.20	2.00	1.0
99. Inst. miscellaneous metalwork	7,000 lb.	.10	.60	.2
100. Inst. embedded elec. met. conduit, under 1½-in. dia	10,000 l. f.	.50	.60	.5
101. As above, 1½ to 3-in.	16,000 l. f.	.50	.80	.6
102. Inst. embedded elec. non-met. conduit	2,000 l. f.	.35	.60	.9
103. Inst. ground wires, grnd. rods	1,500 lb.	.25	.80	.3
104. Transport all freight for gov't., between Mountain Home, Idaho and dam site. (not constructor's frt.)	1,500 ton	4.80	15.00	6.0

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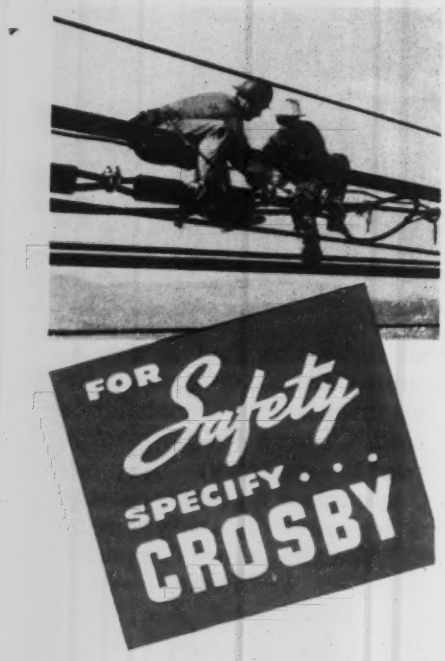

The two riggers shown above are working 460 feet above the Sacramento River at Shasta Dam, California. They might look like men who take long chances, but they don't. They are cool-headed, experienced and sure of themselves. They want equipment they can be sure of. They get it too for those are CROSBY CLIPS they are putting on the cableway.

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when ordering wire rope clips. Then you can be sure you are safe. The word "clips" covers a lot of "cats and dogs," but the trade name "Genuine CROSBY CLIP" is real assurance of maximum safety. Standardize on the Genuine CROSBY CLIP. It's designed right for greatest grip; Drop Forged Steel; Hot Dip Galvanized.

Reports and Pamphlets

(*Continued from p. 76*)

CODE FOR MEASUREMENT OF WATER USING STANDARD ISA ORIFICES WITH FREE DISCHARGE—Published by Hydraulic Institute, 90 West St., New York. Price $1.

Recent publications by the National Bureau of Standards under the general title BUILDING MATERIALS AND STRUCTURES are: Methods of Estimating Loads in Plumbing Systems (BMS65); Structural Properties of "Mu-Steel" Prefabricated Sheet-Steel Constructions for Walls, Partitions, Floors, and Roofs (BMS67); Performance Test of Floor Coverings for Use in Low-Cost Housing: Part 3 (BMS68); Stability of Fibre Sheating Boards as Determined by Accelerated Aging (BMS69); Asphalt-Prepared Roll Roofings and Shingles (BMS70); Fire Tests of Wood- and Metal-Framed Partitions (BMS71); Structural Properties of "Precision-Built, Jr." Prefabricated Wood-Frame Wall Construction (BMS72); Indentation Characteristics of Floor Coverings (BMS73); and Structural and Heat-Transfer Properties of "U.S.S. Panelbilt" Prefabricated Sheet-Steel Constructions (BMS74). Price, BMS 67, 68, 70 and 74, 15c.; BMS 71, 20c; others 10c.

SOIL MECHANICS NOMENCLATURE—Manual of Engineering Practice No. 22. Published by the American Society of Civil Engineers, 33 West 39th St., New York. Price to non-members 40c.

GODFREY'S STRUCTURAL TABLES—By Edward Godfrey. Privately published by the author, structural engineer, Robert W. Hunt Co., Professional Bldg., Pittsburgh, Pa. Price $1.25.

REFERENCES ON THE GREAT LAKES-SAINT LAWRENCE WATERWAY PROJECT—Bureau of Agricultural Economics, U. S. Dept. of Agriculture, Washington, D. C.

READING LIST IN REGIONAL PLANNING—Fogg Art Museum, Harvard University, Cambridge, Mass.

MAPS OF THE MISSISSIPPI RIVER—Cairo, Ill. to the Gulf of Mexico, La. Mississippi River Commission, Vicksburg, Miss. Ninth Edition. Price 75c.

A QUARTER-CENTURY OF CITIZEN CONCERN WITH GOVERNMENT—A Preface and A Bibliography of the Detroit Bureau of Governmental Research, 5135 Cass Ave., Detroit, Mich.

BRIDGES AND AERODYNAMICS—By D. B. Steinman, Consulting Engineer, 117 Liberty St., New York. Reprint from the *Proceedings* of the American Toll Bridge Association.

A CENTURY OF READING COMPANY MOTIVE POWER—Published by the Reading Company, Philadelphia, Pa.

PRINCIPLES OF SEWAGE TREATMENT—Published by the National Lime Association, Washington, D. C. Limited free distribution.

EARTHQUAKE RECONSTRUCTION ON QUETTA (RAILWAY) DIVISION 1936-40—By R. O. C. Thomson. Copies obtainable from The Manager of Publications, Delhi, India. Price Re. 1-8-0 or 1s. 3d.

AN ANALYTICAL AND EXPERIMENTAL STUDY OF THE HYDRAULIC RAM—Published by the Engineering Experiment Station, Bulletin Series No. 326, University of Illinois, Urbana, Ill. Price 70c.

FATIGUE TESTS OF WELDED JOINTS IN STRUCTURAL STEEL PLATES—Published by the Engineering Experiment Station, Bulletin Series No. 327, University of Illinois, Urbana, Ill. Price $1.

PLANE-STRAIN DISTRIBUTION OF STRESS IN ELASTIC MEDIA—Bulletin 148. Published by Iowa Engineering Experiment Station, Ames, Iowa.

THE DEFLECTION OF BEAMS—By Robins Fleming. Published by American Institute of Steel Construction, New York City.

CARDINAL PRINCIPLES IN LOCATION AND DESIGN OF COMMERCIAL AIRPORTS AND THEIR APPLICATION TO THE WASHINGTON AIRPORT—By Howard H. Houk. Reprinted from Highway Research Board *Proceedings*, December, 1940; Washington, D. C.

THE UNIFORM ACT REGULATING TRAFFIC ON STREETS AND HIGHWAYS—Published by the Dept. of Highways, Columbus, Ohio.

TECHNICAL LETTERING—By Paul De Garmo and Finn Jonasses. Published by The Macmillan Co., New York City. Price $1.

STATE PLANNING 1939 and 1940—Prepared and published by the Maryland State Planning Commission. Price 50c.

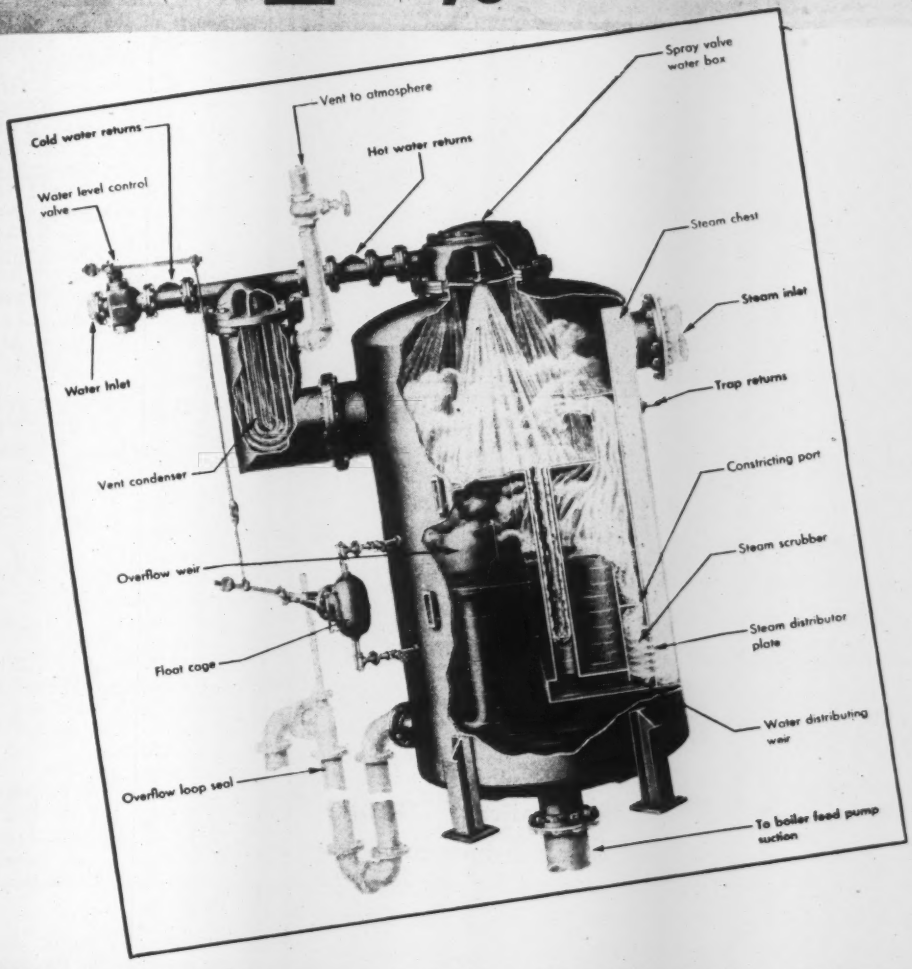
BRITISH CITIES AT WAR—Report by James L. Sundquist for the American Municipal Association. Copies obtainable from the Public Administration Service, 1313 East 60th St., Chicago, Ill. Price $1.

DRAINAGE DISTRICT ORGANIZATION AND FINANCE 1879-1937—Vol. 7, Survey of Local Finance in Illinois. Prepared by Illinois Tax Commission in cooperation with Work Projects Administration.

THE BOARD OF WATER COMMISSIONERS—59th Annual Report of the City of St. Paul, Minn.

(*Continued on p. 82*)

To remove all oxygen and free CO_2



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Permutit's Deaerating Heater not only removes all oxygen (Winkler test) and free CO_2, but also removes some of the half-bound CO_2, increasing the pH value of feedwater. This better corrosion-protection is accomplished in two stages: In the first, most of the oxygen and free CO_2 are removed by spraying the water through steam. In the second, deaeration is made complete by vigorously boiling the preheated water with the incoming steam in the steam-scrubber.

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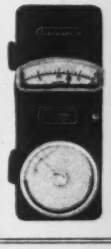

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FAST readings within 3/10 of 1% CO_2
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We'd like you to see the plant that will turn out concrete faster than it has ever been poured before on dry dock construction. We'd like to show you the Butler plants working on every phase of the national defense program—air bases, ordnance depots, cantonments, factories, TNT plants, naval supply depots.

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(*Continued from p. 80*)

LITTLE ROCK MUNICIPAL WATER WORKS—Fifth Annual Report, 1940.

WATER DEPARTMENT—41st Annual Report of the City of Dubuque, Iowa, 1940-41.

THE SIGNIFICANCE OF VARIOUS METHODS OF TESTS USED ON ASPHALTIC PAVING MATERIALS—Research Series No. 6; A DIRECT METHOD OF DETERMINING THICKNESS OF ASPHALT PAVEMENT WITH REFERENCE TO SUBGRADE SUPPORT—Research Series No. 7; and REQUIRED THICKNESS OF ASPHALT PAVEMENT IN RELATION TO SUBGRADE SUPPORT—Research Series No. 8. Published by The Asphalt Institute, 801 Second Ave., New York City.

CLASSIFICATIONS OF STABILIZATION AND THE ELEMENTS OF EXPENSE IN A TYPICAL ASPHALT STABILIZATION PROJECT—Information Series No. 42. Published by The Asphalt Institute, New York City.

SPECIFICATION FOR ASPHALT ENAMEL PROTECTIVE COATINGS FOR STEEL WATER PIPE—The Asphalt Institute, New York City.

CONSTRUCTION SPECIFICATION CL-4 for Cold-Mix-Cold-Laid Emulsified Asphalt Plant-Mix Base and Surface Courses. The Asphalt Institute, New York City.

A GEOLOGIC INTERPRETATION OF THE FAILURE OF THE CEDAR RESERVOIR, WASHINGTON—Bulletin No. 107, Engineering Experiment Station, University of Washington, Seattle, Wash. Price 25c.

NUEVAS TECNICAS EN LAS CONSTRUCCIONES DE HORMIGON ARMADO—By N. J. Ottonello. Talleres Graficos "Tomas Palumbo," Buenos Aires.

SLAG FOR DEFENSE CONSTRUCTION—Published by the National Slag Association, 644 Earle Bldg., Washington, D. C.

1940 TEXAS HIGHWAY ACCIDENT FACTS—Texas Highway Dept., Traffic & Safety Division, Austin, Texas.

MANUAL OF RECOMMENDED PRACTICE FOR SAXE WELDED ERECTION SYSTEM—Copies may be obtained from J. H. Williams & Co., 400 Vulcan St., Buffalo, N. Y. Price $1.

TEMPORARY SALARY STANDARDIZATION BOARD—4th Report, State of New York, Albany, N. Y.

PITTSBURGH, Pa.—Annual Report of the City Planning Commission, 1940.

BOARD OF WATER AND POWER COMMISSIONERS of the City of Los Angeles. 1940. 39th Annual Report.

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WATER TIGHTNESS
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THIS COMBINATION OF CONCRETE AND STEEL can really "take it"!

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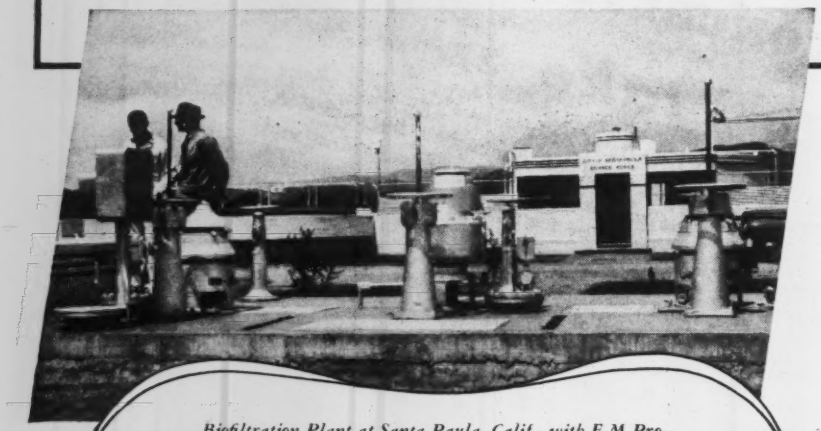

Biofiltration Plant at Santa Paula, Calif., with F-M Propeller Pumps in the foreground.

* * *

Stockton (Calif.) State Hospital Farm Biofiltration Plant, with F-M pumping units on deck of Recirculation Chamber.

THE Biofiltration Process, becoming recognized as one of the most important contributions to sewage disposal, requires low-head pumps of unusually high capacities—pumps capable of circulating up to three times the average rate of sewage flow.

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MEN AND JOBS

Keith Bahrenburg, chief designer in the road office of the Wyoming highway department at Cheyenne for the past 4 years and with the department for the past 15 years, resigned July 21 to accept a position as superintendent of construction for A. H. Read, contractor, of Cheyenne.

J. L. Brenden, Bismark, N. D., assistant engineer for the North Dakota State Water Conservation Commission, has resigned to accept a U. S. civil service appointment as associate engineer in the constructing quartermaster's department with the army engineers at Omaha, Neb. At one time Mr. Brenden was connected with the state highway department.

David F. Giboney, civil engineer and former chief district manager of WPA, has been appointed director of the new WPA Division of Training and Reemployment. Mr. Giboney served with the U. S. Army Engineers in the World War and received a personal citation from General Pershing.

W. R. Wallis has been engaged as associate structural engineer for the U. S. Engineer Office in Los Angeles. Formerly Mr. Wallis was with Allied Engineers, a consulting firm, and Taylor & Taylor, architects, both of Los Angeles.

William H. Rogers, Jr., assistant division engineer for the North Carolina highway and public works commission at Wilson, N. C., has been appointed deputy commissioner of the new North Carolina state department of motor vehicles.

Allen E. Plummer, formerly assigned to the public works department, Bureau of Yards and Docks, Mare Island Navy Yard, has been transferred to the U. S. Army Engineers, Honolulu, T. H., and assigned as associate engineer, Cost Section.

C. W. Borders, who was formerly with the engineering department of the state highway department, is now city engineer of Waco, Tex.

Joseph M. Marshall, Jr., formerly engineer inspector for PWA in Georgia, has been appointed district engineer for the American Institute of Steel Construction with headquarters at Atlanta. **Carl Baer,** former design engineer for the city of Dallas, Tex., has beeen summoned for service as a major on the staff of the Eighth Construction Zone at San Antonio, Tex. Major Baer had been

When tanks were only tractors with tin Hats—

Hyatts kept them going—*then*
Hyatts keep them going—*now*

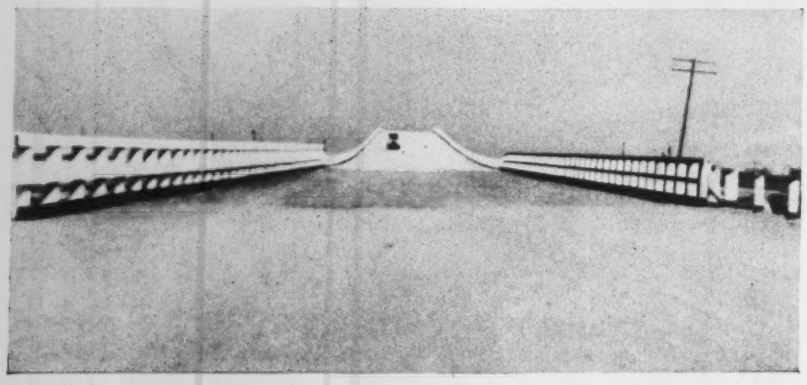
TANKS . . . the "surprise weapon" of the Allies in the last war . . . were inspired by tractors with crawler treads perfected by Holt. Cushioning the shocks, keeping operating parts running true, Hyatt Roller Bearings helped carry the load and ably won their chevrons. Then back to "civvies," improved Hyatts have been doing their peace-time job well ever since. Therefore, these dependable bearings are again being drafted for tanks as well as army trucks, gun mounts, airplanes and other equipment in today's defense program. Hyatt Bearings Division, General Motors Sales Corporation, Harrison, N. J., Chicago, Pittsburgh, Detroit, San Francisco.

PHOTO BY U. S. ARMY SIGNAL CORPS.
Like tanks, Hyatts have been improved in design, but their traditional quality manufacture prevails even through "all out" production.

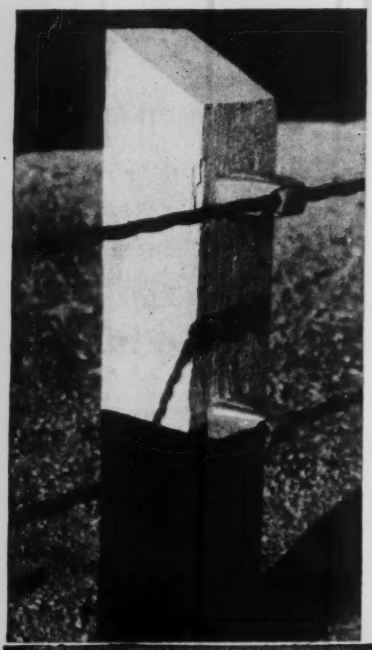
HYATT
Quiet
ROLLER BEARINGS

(*At top*) *Allied photo taken "Somewhere on the Western Front," 1915 is that of a Holt Caterpillar Tractor with front wheel . . . prototype of present "Caterpillar" full crawler tractor of today.*

PROTECTION *on the Highway!*



GUARD RAIL POSTS PRESERVED WITH DU PONT "CZC"



GREATER safety on the highway and lower annual maintenance costs are the two outstanding benefits contributed by "CZC" treated guard rail and posts. Because lumber treated with "CZC" is not only protected against decay and termites but it's also fire retardant.

In all kinds of construction the advantages of "CZC" treated wood have led to its increasing use from bridges to boardwalks, from hangers to houses. And in addition to its durability under severe conditions "CZC" treated wood is clean, odorless and paintable.

Complete information is published in the new bulletin, "Facts about Du Pont 'CZC'". Write for your copy today. E. I. du Pont de Nemours & Company (Inc.) Grasselli Chemicals Department, Wilmington, Delaware.

SPECIFY LUMBER TREATED WITH DU PONT CZC
CHROMATED ZINC CHLORIDE

in city service for the past twelve years and was recently on leave of absence engaged in the building of the army replacement center at Mineral Wells, Tex.

William D. Shannon, for many years northwest manager of Stone & Webster Engineering Corp., Boston, has been appointed district manager for a new Seattle, Wash., branch office of the priorities division of the OPM. Mr. Shannon supervised construction of many power projects in the Puget Sound area and built the first trunk transmission lines over the Cascade Mountains in Washington and the Sierra Nevadas in California.

Arthur E. Stanley, of Stanley Engineering Co., Muscatine, Iowa, a captain in the Reserve Corps, has reported for military duty, and is now stationed at the Air Corps Advanced Flying School, Luke Field, Phoenix, Ariz.

R. V. Hoops, former vice-president of the Great Lakes Dredge & Dock Co., Chicago, has been elected president of Woods Bros. Construction Co., Omaha, Neb., who recently moved their offices to Omaha from Lincoln.

C. J. Leblanc has been named general engineer, City of Montreal, acting under **J. E. Blanchard,** director of public works.

F. C. Smith, district engineer for the Nebraska state highway department, who has been stationed at McCook, was transferred to Lincoln Aug. 11 to become equipment engineer, a new position in the department. **C. Lyle Carey,** district engineer now stationed at Ainsworth, has been shifted to McCook to succeed Mr. Smith, and **L. N. Ross,** a project engineer at Bridgeport, went to Ainsworth as district engineer.

Lieut. Comdr. Arthur F. Perry, Jr., of Jacksonville, Fla., a veteran of the public works department of the Naval Air Station, has been called to the Bureau of Yards and Docks of the Navy Department in Washington. Formerly a civilian engineer in Jacksonville, Comdr. Perry joined the staff of the station last year during the early phase of the construction program.

Lieut. Albert Wynot, of Boston, has reported for duty as project engineer at the Charleston, S. C., municipal airport, which is being enlarged under the supervision of the U. S. district engineer's office.

Lieut. Joseph W. Butkiewicz, of New York, has been assigned to a year's active duty beginning Aug. 8, and **Lieut. John Harry Fellows,** of New

Jamaica Race Track gets new Grandstand

Copyright Richard Averill Smith

Built for the Metropolitan Jockey Club. Architect Aymar Embury II. General Contractors, Roberts Nash Construction Corporation.

Built by American Bridge Company

ANOTHER example of the diversity of American Bridge Company's structural activities is this modern grandstand for the modernized Jamaica Racetrack in Springfield, Long Island, N.Y.

Replacing an old outmoded grandstand built in 1903, this up-to-date structure provides the utmost in convenience and comfort for the patrons of this track.

It covers a ground area 120 feet by 1020 feet with upper and lower seat decks and roof steel-framed throughout. The more than 1800 tons of steel required, including the framework for the judges' stand, radio and tote observer rooms and a 250-ft. ramp to the railroad station, were completely fabricated and erected by American Bridge Company.

Whatever the type of steel structure needed for whatever purpose or wherever its locale, the chances are its building is just part of the day's work for American Bridge Company. With more than fifty years of accumulated experience and unsurpassed engineering personnel, facilities and resources, no job is too large or too difficult for American Bridge Company engineers to undertake.

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General Offices: Frick Building, Pittsburgh, Pa.

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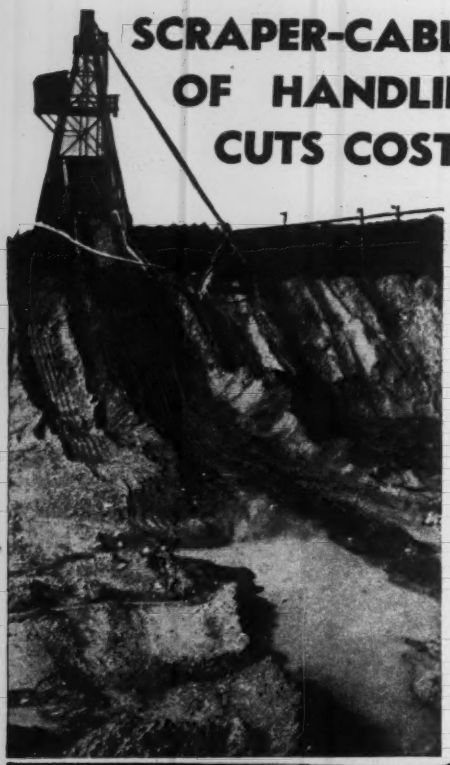
Columbia Steel Company, San Francisco. *Pacific Coast Distributors* United States Steel Export Company, New York

UNITED STATES STEEL

SCRAPER-CABLEWAY METHOD OF HANDLING MATERIALS CUTS COSTS TO THE BONE



ON WORK where materials have to be moved 100 to 1000 ft. or more, a Sauerman machine cuts costs by being able to dig, haul and place the material in a continuous, straight-line operation, doing away with the expense of rehandling. One man controls the entire operation.

The complete line of Sauerman scraper and cableway machines includes sizes to meet all capacity requirements. There are light, portable units for small yardage jobs and there are great powerful machines that take a 15 cu. yd. load of material at a single bite and haul this big load across the ground at a speed of 300 feet per minute.

Typical examples of pit and bank excavation, alluvial mining, moving blasted ore, deep dredging, stock-piling and reclaiming, etc., are illustrated in the Sauerman catalog. Write for your copy of this useful book.

SAUERMAN BROS., Inc.
432 S. Clinton St. CHICAGO

Sauerman LONG RANGE MACHINES

See page 30 of our new 96-page catalog for information on this

WATER PRESSURE REDUCING VALVE

Illustrated—
Single Globe
Pilot Pattern

These valves maintain a constant downstream pressure against any higher upstream head;

—operate without any shock or jar, owing to inherent air and water cushioning;

—and they do not hunt in positioning themselves for the necessary rate of flow, owing to the sensitive pilot valve control —thus *wear* on the renewable cups and seat washer is *minimized.*

GOLDEN-ANDERSON VALVE SPECIALTY CO.
Fulton Building Pittsburgh, Pa.

CONCRETE PIPE

FOR ALL DRAINAGE AND WATER SUPPLY PURPOSES

Shipped from our permanent plants or manufactured at the site by one of our mobile units.

CONCRETE PIPE EQUIPMENT

FOR SALE OR LEASE

For manufacture of pipe by engineers and contractors at remote locations.

CONCRETE CRIBBING

UNIVERSAL CONCRETE PIPE COMPANY

MAIN OFFICE
COLUMBUS OHIO

Plants can conveniently serve projects in: Massachusetts—Connecticut—New York—New Jersey —Pennsylvania—Ohio—West Virginia—Georgia—Florida—Michigan—Indiana — Illinois—Tennessee —Kentucky—North Carolina—South Carolina.

Bedford, Mass., has been ordered to a year's active duty beginning Aug. 12 with the U. S. District Engineer's Office in Charleston.

Frank R. Burnette has been appointed assistant chief engineer of the Carnegie-Illinois Steel Corp., Pittsburgh. After many years with American Steel & Wire Co., Mr. Burnette joined Carnegie-Illinois as construction superintendent in 1939.

Frederick K. Teichmann, associate professor of aeronautical engineering in the New York University College of Engineering, has been appointed acting director of the department of aeronautical engineering, and **Charles E. Gus,** executive secretary of the college, has been promoted to professor of engineering mechanics. Professor Teichmann succeeds **Dr. Alexander Klemin,** who became Guggenheim Research Professor of Aeronautics last spring.

J. Burke Crockett, of Dallas, Tex., civil engineer and general contractor, has been appointed district manager of the Dallas field office in the priorities division of the OPM.

S. C. Austin, of Asheville, N. C., present assistant division engineer in the Tenth District, has been appointed equipment engineer of the state highway and public works commission, a newly created position. **D. W. Davis,** who was dividing his time between equipment and maintenance, will remain as maintenance engineer.

Victor L. Streeter, associate hydraulic engineer for the International Boundary Commission (U. S. Section), United States and Mexico, has accepted an appointment as associate professor in the field of hydraulics and hydrology in the civil engineering department of the Illinois Institute of Technology at Chicago. A graduate of the University of Michigan, Mr. Streeter was formerly with the Bureau of Reclamation in Denver.

Arthur C. Harris has been named assistant commissioner of works and assistant city engineer of Halifax, Nova Scotia. Mr. Harris is a graduate of Dalhousie University and was formerly connected with the Dominion Bridge Co., Ltd.

Bayard P. Fonda, of Towson, Md., has been appointed to the newly created office of building engineer for Baltimore County, Md. Mr. Fonda's duties will be to formulate and enforce a new building code for the county which will regulate the rapid expansion now taking place. Mr. Fonda is a partner in the firm of

TOLERANCE

We know only too well how much you need steel. We are doing everything humanly possible to get it for you. Every man in this company is doing his utmost to produce every possible pound of material.

Because of the seriousness of this nation's emergency, defense must come first. We are cooperating with the Government to the limit as you would want us. At the same time we are keenly aware of the needs of our customers, and we are doing our best to serve you, too.

Tolerance is one of the virtues that will help tremendously in this hour of our country's need.

THE YOUNGSTOWN SHEET AND TUBE COMPANY

YOUNGSTOWN, OHIO

TRY Columbia TRACING CLOTH

Here is the latest innovation in TRACING CLOTH containing all of the fine qualities which the most expert draftsman desires. Tested and proven in quality for surface efficiency. Cleans easily. Corrections of ink or pencil made easily, but the superiority of this NEW Tracing Cloth is best proven by use and you are urged to send for a large working sample sheet. We shall abide by your decision.

THE Columbia MILLS
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225 FIFTH AVENUE
NEW YORK, N. Y.

Fonda & Warfield, consulting mechanical and construction engineers and building appraisers.

The Pennsylvania department of highways has announced the appointment of **Edwin C. Doud,** of Kennett Square, as assistant materials engineer, to be stationed at central offices of the department in Harrisburg. Other additions to the engineering staff are: **Walter A. Lovell,** of Ashland, project engineer to District No. 5 at Allentown, and **Leo T. Ruffner,** of Swissvale, project engineer at District No. 11, headquarters at Pittsburgh.

Dr. Arthur S. Adams has been appointed assistant dean of the College of Engineering at Cornell University. During the last eight months Dean Adams has supervised defense courses with a total enrollment of more than 2,700 part-time students from defense industries and the U. S. Navy.

David D. Jones, Jr., has been appointed assistant manager for a U. S. Defense Housing project at Wilmington, N. C.

Hal T. Macon has been appointed chief right-of-way engineer for the North Carolina state highway and public works commission and will be located at Raleigh.

R. R. Litehiser, on leave of absence as chief engineer of the bureau of tests of the Ohio department of highways and now with the U. S. Army, has just been advanced to the rank of lieutenant colonel. Col. Litehiser is on duty at the port of embarkation in Brooklyn, N. Y.

H. A. Terreault, chief engineer, Montreal Town Planning Commission, has been named as technical adviser in the construction of munition plants, Department of Munitions and Supply, Ottawa.

Robert L. Telford, formerly general superintendent of Mason & Hanger at the Radford Ordnance Works, Radford, Va., is now general superintendent and engineer for Silas Mason & Co., Shreveport, La., on construction of a shell loading plant.

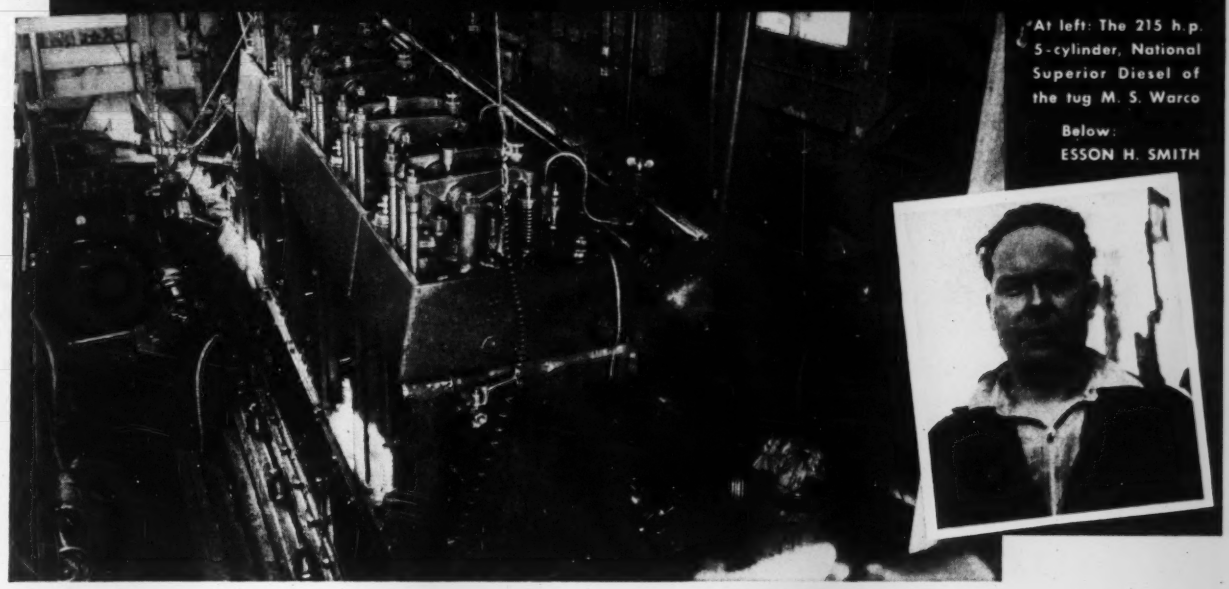
Halle Shaw has been elected city engineer of Holly Springs, Miss.

L. F. Whearty, formerly director of operations for the former first district of WPA for the state of Kansas, has been appointed state director of public works reserve with headquarters to be opened in the Federal Building at Topeka.

Frederick H. McDonald, industrial and development engineer for the South Carolina Public Service (Santee-Cooper)

BELIEVE IT OR NOT!*—
"IN THIS DIESEL... MUCH BETTER RESULTS WITH RING-FREE THAN ANY OTHER OIL WE'VE TRIED"

—SAYS C. T. SMITH & SON
TUG BOAT OPERATORS, STEVENSON, WASH.



At left: The 215 h.p. 5-cylinder, National Superior Diesel of the tug M. S. Warco

Below: ESSON H. SMITH

Says Esson H. Smith, "With other oils we often had trouble with pistons and valves. After a complete overhaul, installing new rings, sleeves, main bearings and connecting rod bearings we used Ring-Free SAE 40. After 3500 to 4000 hours, a general check-up showed: wear, fore and aft at top, only .002; we could detect no wear at bottom of each cylinder nor was wear, port and starboard, in any case over .0015. The main bearings were in perfect shape." Mr. Smith then tacks on this P.S., "The diesels in our tugs 'Charles T' and 'Sakana' are using Ring-Free with equal success." Ring-Free has a powerful story to tell ANY diesel operator. Want to see it? Call the Macmillan Man ... or write direct.

MACMILLAN PETROLEUM CORPORATION

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Believe It or Not! by Ripley
REG. U. S. PAT. OFF.
RING-FREE IS NOT JUST A ONE-TIME MOTOR-TONIC-IT'S A PURE OIL THAT CLEANS YOUR MOTOR CONSTANTLY - AS IT LUBRICATES!
HOW RING-FREE REMOVES CARBON AND TURNS THE OIL BLACK
DIRTY HANDS
CLEAN WATER
SOAP
CLEAN HANDS
BLACK WATER
DIRTY MOTOR
RING-FREE
CLEANER MOTOR
BLACK OIL

—as drawn by Ripley in Life, Collier's, Time

MACMILLAN
RING-FREE
MOTOR OIL

*Reg. U. S. Patent Office

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FOR THE DEFENSE OF LIBERTY!

Outdoor Permite Ready-Mixed Aluminum Paint is doing its part in the defense of liberty through helping industry guard against the ravages of nature's destructive forces — snow, wind, rain, sun and fumes. Through its remarkable ability to protect all types of surfaces, Outdoor Permite provides armor-like resistance to the attacks of nature's silent army. Unlike ordinary paint, it forms an overlapping series of protective aluminum layers, opaque to light and impervious to moisture. Outdoor Permite hides better, spreads farther and lasts longer. Being completely ready-mixed, it is easy to use, saves times, saves waste.

Although the needs of the National Defense Program must come first, we are rapidly expanding our production facilities and doing everything possible to catch up with the ever-growing demands for all types of Permite *Ready-Mixed* Aluminum Paints.

ALUMINUM INDUSTRIES, Inc., Cincinnati, Ohio

DISTRIBUTORS IN PRINCIPAL CITIES

Outdoor PERMITE

READY-MIXED ALUMINUM PAINT

authority, has resigned to resume private practice as a consulting engineer and will open offices at 1 Broad St., Charleston, S. C. He will be succeeded in the authority's offices by **William J. Valentine,** his former assistant.

George Cobb, chief engineer of the department of public works at Baltimore, will be responsible for the management of the municipal airport which will be a function of the department.

John Klorer of New Orleans, La., has been appointed supervising engineer of the engineering division of the RFC, with headquarters in Washington.

Charles H. Mottier, since 1935 assistant to the vice president and chief engineer of the Illinois Central Railroad, became chief engineer in July. Mr. Mottier has been with the company since 1911, serving successively as assistant engineer, office engineer and engineer of design. **Fred L. Thompson,** who has been vice president and chief engineer, continues vice president in charge of the engineering department.

D. P. Curry, assistant chief health officer, has retired after over 22 years service in the health department of the Panama Canal Zone. He was in service with the Medical Corps of the Army during the World War. While in Panama he became an authority on tropical sanitation and on the subject of mosquitos and mosquito control. Dr. Curry is a native of Kentucky and was educated in engineering and medicine at the University of Kentucky.

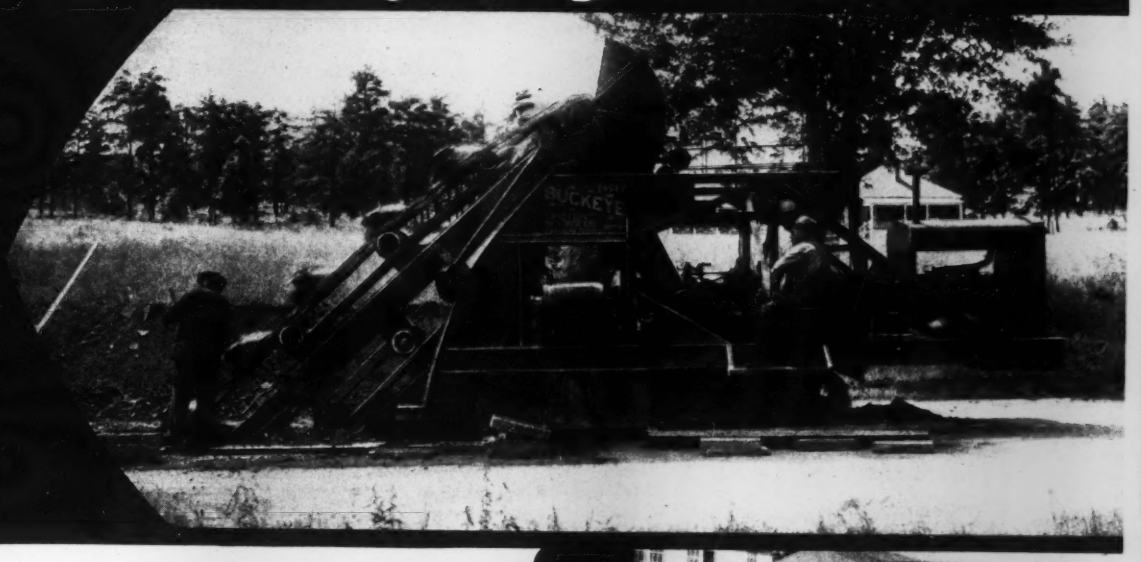
Raymond W. Sauer, senior engineer, assistant chief, engineering division, U. S. Engineer Office, Huntington, W. Va., district, has been transferred to the Vicksburg, Miss., district office.

F. H. Dryden, of Baltimore and Salisbury, Md., has been appointed deputy commissioner of WPA. Mr. Dryden received his civil engineering degree from the University of Maryland; at the time of the World War he was a division engineer. For a number of years he served as consulting engineer to a group of Maryland and Delaware municipalities. Before entering the service of WPA in 1935, he was chief engineer for the Maryland Civil Works Administration. Mr. Dryden was city engineer of Salisbury for 13 years.

Elmer Klement, city engineer, has been named acting city manager of Fort Atkinson, Wis., to fill temporarily the vacancy created by the resignation of city manager **Richard Biehl,** who has accepted a new post at Portsmouth, Ohio.

6½" Asphalt Pavement Doesn't Faze a Buckeye✓ Trencher!

Model 160 Buckeye
encher, digging in
burban Atlanta, aver-
ed better than 500 ft.
day of trench 12 to 20
deep and 36" wide,
tting through 6" of im-
cted asphaltic base
terial and a ½" mat
thout retarding the
ogress of the machine
natsoever.

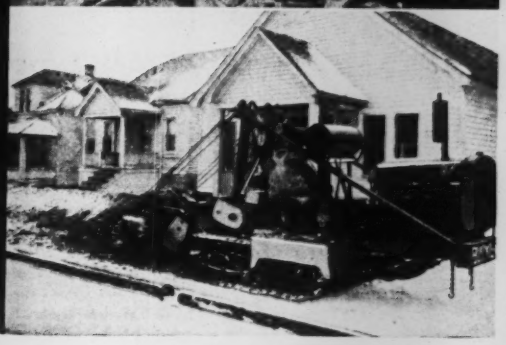


Performance like this is not just in isolated cases—it's being done every day by all types and models of Buckeyes—both rotary wheel and boom types. That's why most contractors and public officials with a trenching job to do think of a Buckeye in terms of getting it done fastest and at the lowest cost per foot of finished trench.

18 Buckeye Models are available to solve any trenching problem—and there's a Buckeye Bull-dozer or Backfiller for fast trench filling, assuring you of maximum savings on the complete job.

BUCKEYE TRACTION DITCHER CO.
FINDLAY, OHIO

This Model 410 got in water and sewer pipe in jig time on a New Hampshire airport job. The Model 11 Wheel Type Trencher below has chalked up many records on gas main and service pipe installations in and around Detroit.



Built by Buckeye✓

ertible Shovels

Trenchers

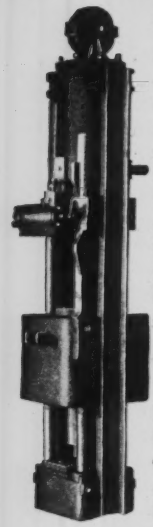
Tractor Equipment

R-B Finegraders

Road Wideners

Spreaders

THE
FIRST
type we made
WARRINGTON-
VULCAN
Single-Acting Steam
PILE HAMMER
IS STILL BEING
USED . . . . .



55 years ago we introduced this rapid, regular, and continuous-acting Pile Hammer. Today great approval is still given to it and this original VULCAN type is in service throughout the country. We still can say for it—low cost for upkeep—easy and inexpensive to operate. The WARRINGTON-VULCAN delivers a moderate frequency of low velocity blows from a relatively heavy ram.

Later VULCAN Types

- It was only natural during the years that we add new types with new advantages so that the industry would have an even greater opportunity for speed and cost savings.
- SUPER-VULCAN Differential-Acting Closed-Type Steam Pile Hammers, 1800—300—5000—8000—to permit underwater work.
- SUPER-VULCAN Differential-Acting Open-Type Pile Hammers, 18c—30c—50c—80c—use 25 to 35 per cent less steam per blow—give twice the number of blows per minute.
- VULCAN Pile Extractors for pulling sheet steel, wood, concrete, H-beam, and pipe piles. Sizes 200, 400, 800.

Write for details.

VULCAN IRON WORKS Since 1852
331 North Bell Avenue
Chicago Illinois

MEETINGS

AIRCRAFT STRUCTURES CONFERENCE, sponsored by Civil Engineering Division, Society for the Promotion of Engineering Education, New York University, New York, N. Y., Sept. 5-6.

PAN-AMERICAN HIGHWAY CONGRESS, fourth exposition, National Stadium, Mexico City, D. F., Sept. 15-24.

AMERICAN Association of State Highway Officials, annual meeting, Statler Hotel, Detroit, Mich., Sept. 29–Oct. 2.

NATIONAL SAFETY CONGRESS AND EXPOSITION, National Safety Council headquarters, Chicago, Ill., Oct. 6–11, 1941.

FEDERATION OF SEWAGE WORKS ASSOCIATIONS, 2nd annual convention, Hotel Pennsylvania, New York, N. Y., Oct. 9–11, 1941.

AMERICAN PUBLIC HEALTH ASSOCIATION, Atlantic City, N. J., Oct. 13–17, 1941.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION, annual convention, The Greenbrier, White Sulphur Springs, W. Va., Oct. 14–17, 1941.

AMERICAN SOCIETY OF CIVIL ENGINEERS, Fall meeting, Palmer House, Chicago, Ill. Oct. 15–17.

AMERICAN WELDING SOCIETY, Bellevue-Stratford Hotel, Philadelphia, Oct. 19–24, 1941.

AMERICAN PUBLIC WORKS ASSOCIATION, 47th annual conference, Roosevelt Hotel, New Orleans, La., Oct. 26–29, 1941.

NATIONAL COUNCIL STATE BOARDS OF ENGINEERING EXAMINERS, Hotel Pennsylvania, New York, N. Y., Oct. 27–30.

REGIONAL AND LOCAL MEETINGS

SOUTH DAKOTA STATE ASSOCIATION OF COUNTY COMMISSIONERS, HIGHWAY SUPERINTENDENTS AND AUDITORS, annual convention, Evans Hotel, Hot Springs, S. D., Sept. 8–10.

SOUTHEASTERN TRAFFIC ENGINEERING CONFERENCE, Clemson College, Clemson, S. C., Sept. 9–12.

NEW ENGLAND WATER WORKS ASSOCIATION, Hotel Statler, Boston, Mass., week of Sept. 23-26.

CANADIAN GOOD ROADS ASSOCIATION, 26th annual convention, General Brock Hotel, Niagara Falls, N. Y., Oct. 7–9.

AMERICAN WATER WORKS ASSOCIATION, Minnesota Section, Minneapolis, Oct. 9–11; New Jersey Section, Atlantic City, N. J., Oct. 16–18.

ILLINOIS WATER PLANT OPERATORS, 9th annual fall meeting, Leland Hotel, Springfield, Ill., Oct. 28–29.

WATER AND SEWAGE WORKS CONFERENCE, 7th annual meeting, Aberdeen, S. D., Oct. 28–29, 1941.

TEXAS SECTION, Am. Soc. of C. E., fall meeting, Fort Worth, Oct. 31–Nov. 1.

ELECTIONS AND ACTIVITIES

MEMBERS OF THE INDIANA section of the American Society of Civil Engineers, accompanied by their families, held their annual meeting with Purdue University students at the Ross Ade civil engineering camp, at Lafayette, Ind. Members of the society were addressed by President Elliott of Purdue University, David Ross of the University Board of Trustees, and by Dean Potter of the Purdue University engineering school. Dean Potter spoke on the subject of "Engineering in National Defense." A special guest at the meeting was R. F. Wilcoxon of the United States Geological Survey.

THE NORTH CAROLINA CHAPTER of the American Society of Heating and Ventilating Engineers held its annual summer convention at Pinehurst, N. C., July 18-20, with W. M. Wallace, II, of Durham, president of the chapter, presiding. R. B. Rice of Raleigh was in charge of the program.

THE SOUTH CAROLINA SOCIETY of Engineers held its annual summer convention at Clemson College, Clemson College, S. C. The South Carolina section of the American Society of Civil Engineers held its annual meeting at the same time. Among the principal speakers were Robert G. Le Tourneau, president of R. G. LeTourneau, Inc., Peoria, Ill.; Dr. S. B. Earle, dean of the school of engineering at Clemson; Dr. R. F. Poole, president of Clemson; J. Stanley Williamson, chief highway commissioner of South Carolina; Dexter C. Martin, South Carolina State Aeronautics Commissioner; and Capt. H. G. Gerdes of the U. S. Engineers.

The 1941 officers of the society are: F. R. Sweeney of Charleston, president; E. L. Clarke of Clemson, vice president; Albert E. Johnson of Columbia, secretary-treasurer.

Officers of the South Carolina section of the American Society of Civil Engineers are: J. E. Gibson of Charleston, president; J. G. Wardlaw of Columbia, vice president; A. E. Johnson of Columbia, secretary-treasurer.

CLYDE A. WALB of Fort Wayne, Ind., has been named president of the Indiana Society of Professional Engineers. Mr. Walb, president of the American Steel Dredge Co. Inc., and the Central Dredging Co. Inc., was vice president of the society and succeeds the late Homer Rupard as president of the society.

Big Stripper Dipper or ⅜ Yard Truck Loader

Amsco Builds a Dipper for Every Material Handling Requirement

Name your shovel capacity and the material you wish to dig and you will find that there is an Amsco Dipper best suited to your particular requirements. Mining, quarrying, clay winning, dredging and construction operations have found this to be the case, judging by the variety of sizes and types of Amsco Dippers in use by those industries, on surface as well as subterranean digging.

A few dippers are exhibited here, to give the reader an idea of the many sizes and types available. At right is a 15 yd. Amsco Renewable Lip Dipper at work at an Illinois coal strip mining operation. It only takes about three dippers full, like this, to fill a gondola car. Severe impacts and abrasion are encountered in stripping overburden to get at the coal bed, so "The Toughest Steel Known" is necessary to "take it."

"U"-bolts on both sides and the interlocking fastening in front make lip changes simple; and, once installed, provide security as though lip were cast integral with body. Teeth are held securely to bases and are readily replaced or reversed. Amsco Renewable Lip Dippers are available in all sizes from ¾ yd. up.

On excavating, pit and other work calling for ⅜, ½ and ⅝ yd. dippers, such as shown (R-331), wear is more evenly

Small Amsco Dippers—⅜, ½ and ⅝ yd. as shown above—have one-piece body; renewable teeth.

distributed; consequently, Amsco dippers in these smaller sizes are of one-piece design without renewable lip but with renewable teeth, of course.

The earliest type of dipper developed by Amsco and still a favorite for ore, rock and coal stripping and loading, clay digging and underwater dredging is Amsco's Missabe Dipper, developed originally for use on the Missabe Iron

Many strip mining operators prefer Amsco Renewable Lip Dippers like the 15 yd. dipper above, stripping overburden at another coal mine.

For over 30 years Missabe Type Dippers, made by Amsco, have been a favorite for ore, rock and coal stripping and loading. 15 yarder in Illinois coal strip mine is shown.

Range in Minnesota; hence the name.

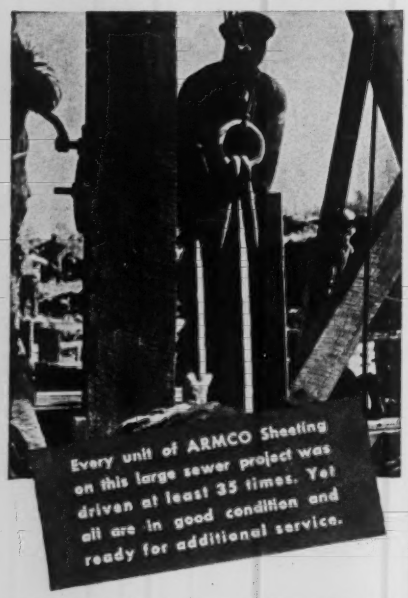
A 15 yd. Missabe in an Illinois coal strip mine is shown (593). It is equipped with Van Clark teeth—one of a score of tooth designs available for Amsco Dippers.

The Missabe's body consists of a front and back casting securely riveted together through overlapping sections. Equalized metal thicknesses distribute stresses from socket casting to lip. Digging stress is on the front casting, eliminating the load on the riveted joint.

Literally thousands of Amsco Missabe Dippers have been made over thirty years and have given their owners maximum service life, economical maintenance and lowest cost per ton of material handled.

Two new bulletins tell the complete story of Amsco Dippers and Power Shovel Parts—Bulletin No. 641-D covers the various types of Amsco Dippers, Dipper Teeth and Parts; Bulletin 641-S covers Power Shovel Parts such as racks, pinions, sprockets, rollers and crawler treads and Dragline sheaves, hitches, chain and other parts. Send to the American Manganese Steel Division of The American Brake Shoe & Foundry Company, Chicago Heights, Ill. for your copies of each.

DRIVEN 35 TIMES ...STILL A-1 SHEETING


Every unit of ARMCO Sheeting on this large sewer project was driven at least 35 times. Yet all are in good condition and ready for additional service.

Many contractors and engineers know from experience that ARMCO Sheeting has what it takes for repeat performances. It is readily pulled and can be used again and again.

Naturally this high salvage value means low material costs on trenches, cofferdams, foundations and similar works. You need less sheeting for big jobs. On smaller projects you save by moving ARMCO Sheeting from job to job, thus eliminating the expense of new material. Between jobs the nestable units take up little storage space.

ARMCO Sheeting helps speed the job too. It drives fast thanks to a comparatively small displacement area. The corrugated metal design combines safe strength with light weight for easy handling.

There is a gage and type of ARMCO Sheeting to meet every requirement. Write us for data regarding its practical application to your jobs. ARMCO DRAINAGE PRODUCTS ASSN., 5012 Curtis Street, Middletown, O.

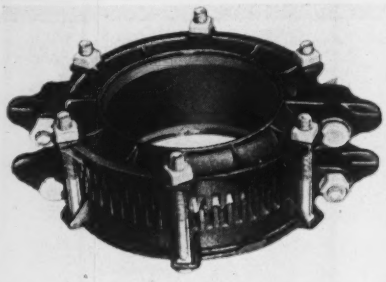
ARMCO SHEETING

New Aids to the Constructor

Equipment and material announcements and manufacturers' news

Earthmover Tire

Goodrich announces a new earthmover tire capable of carrying tremendous loads. Named the Universal super-traction tire, it has a non-directional tread designed to give two-way traction, and a minimum of side-slippage in service on the sides of hills or ditches. The new tread, composed of a series of V-shaped wedges that are self-cleaning and will not clog in soft or muddy going, makes the tire especially suited for use on logging trucks in lumber camps where off-the-road traction, and slow even tread wear for movement over highways are required. Matching the long-wearing tread is an unusually heavy thickness of rubber on the sidewalls to protect the tire against chafing and cutting.—*The B. F. Goodrich Co., Arkon, Ohio.*

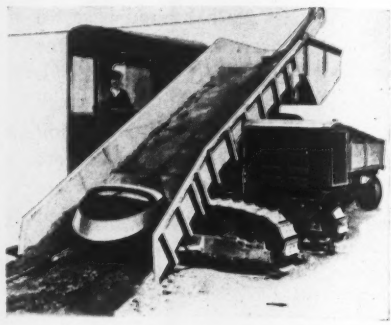


Split Coupling Clamp

A split coupling clamp, designed for repair of broken cast iron mains, is said to require only 15 min. to install. It not only splices the break but insures against recurrence of trouble by introducing a degree of flexibility in the line at the point repaired, and can be used for pinhole leaks or splits in cast iron brazed joints. The Skinner-Seal split coupling clamp consists of two sturdy malleable iron intermeshing compression rings, halved; Monel metal seal band, a heavy triangular shaped gasket, break-covering brass band, and electro-plated high tensile steel bolts. The molded gasket is 5¼ in. wide, of very soft gum and carbon black with hard vulcanized tips at the outer edges. As the intermeshing compression rings are drawn together by the pull bolts, the finger projections intermesh and the gasket is uniformly compressed.—*The M. B. Skinner Co., South Bend, Ind.*

Heavy Duty Sander

A new sander designed for faster production-line use with 9-in. abrasive discs is said to cover more area, and turn out more work than any production sander previously offered. It has a new, fast spindle lock for quicker change of pads and abrasive discs.—*Black & Decker Mfg. Co., Towson, Md.*



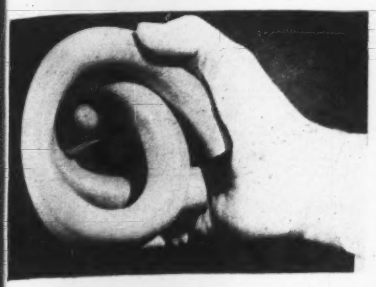
Scraper-Loader

A crawler-mounted Scraper-Loader of new and interesting design has recently been introduced, a unique feature being a hydraulically controlled "teetering" ramp. The machine is equipped with a 1 cu. yd. Crescent scraper bucket. The scraper drag cables are 400 ft. long. The power unit which operates the scraper bucket is a double-drum hoist driven by either a 60 h.p. gasoline or Diesel engine or by a 40 h.p. electric motor. Power is furnished to the crawlers from a take-off on the hoist. In handling loose material from a pit, bank or stock-pile 400 ft. wide, this machine will load an average of eight 5-ton trucks per hour, assuming that the bucket is operated to maintain an average length of haul of 200 ft. Any reduction in haul brings a proportionate increase in hourly capacity. When moving around a job or to a new location, the front of the "teetering" ramp is raised from the ground and held in place by hydraulic rams.—*Sauerman Bros., Inc., 432 S. Clinton St., Chicago, Illinois.*

FWD Axle

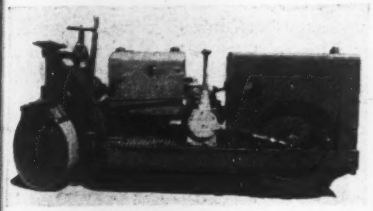
Featuring the same basic heavy duty construction as the famous "U" series axle used in FWD trucks up to 6 tons capacity, a new "H" series axle just announced brings to users greater axle efficiency through simplified design and engineering. The driving mechanism in both the front and rear axles is fully inclosed and all moving parts are doubly protected by special oil seals that retain the lubricant and exclude abrasives. The

free acting axle differential is sturdily constructed with a forged steel case and has extra large size gears. Split ring universal joints, through which power is transmitted to the front wheels, provide a maximum cramp angle of 30 deg. permitting a short turning radius without interference with the free rolling of the axle shaft.—*The Four Wheel Drive Auto Co., Clintonville, Wis.*



Air Hose

A new lightweight air hose so flexible that the ½ in. size can be bent to a 3 in. radius without collapsing or cutting off the air supply is now available. The hose is stocked in ½ and ¾ in. sizes for working pressures of from 80 to 125 lb.—*The B. F. Goodrich Co., Akron, Ohio.*

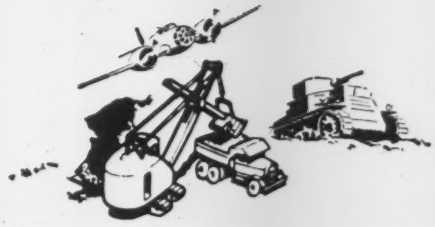


Tandem Roller

A new all steel California tandem roller is designed to provide paving contractors with an efficient, dependable machine at an economical price. It has four speed transmission either in reverse or ahead, easy steering and is powered by a 4 cylinder Waukesha motor. The drum and clutch used are made of Ford parts as is the silent running truck transmission.—*Wheeler Mfg. Co., Los Angeles, Cal.*

Sensitized Materials

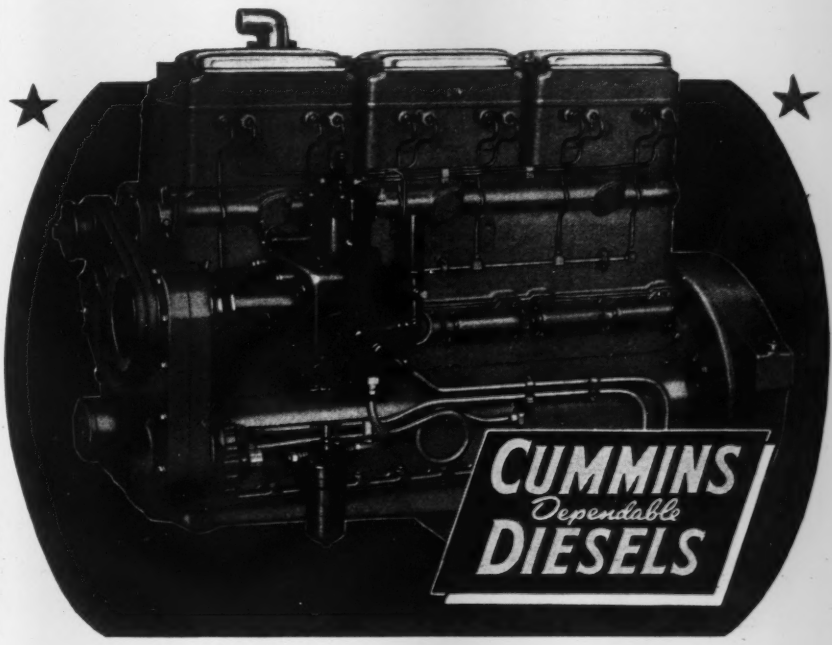
Following development of a process whereby photographic reproduction can be made on sensitized aluminum sheets, further research has completed a new process whereby other materials such as steel plates, brass, copper, various steel alloys, plywood and plastics coated with sensitized emulsion are available suitable for making photographic copies of all kinds and for all purposes. Some of these sensitized materials can be secured in any commercial thickness of the type used for making templates. The drawing is photo-



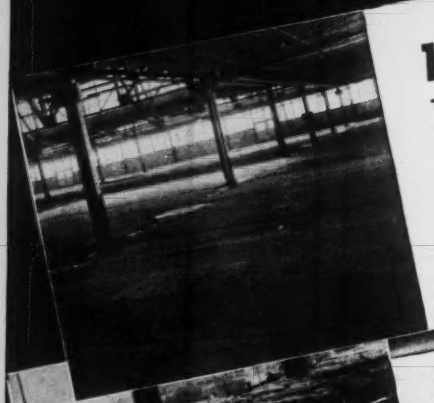
WHERE DEFENSE BEGAN

Speed! Mobility! Hitting power! Staying power! These are the objectives toward which America's armed forces are working today . . . the objectives which the nation's leading contractors have already attained by standardizing on Cummins Diesel power . . . by taking advantage of the Cummins Dependable Diesel's supreme flexibility, high torque and day-after-day dependability which assure faster, uninterrupted work cycles on the toughest jobs. It was this application of modern power and modern methods to modern needs that marked the real beginning of America's defense effort . . . it was this keen foresight which has enabled the construction industry to perform such tremendous service in the interest of National Defense. Cummins Engine Company, 3616 Wilson Street, Columbus, Indiana.

ILLUSTRATED: *Model HBI-600 Cummins Dependable Diesel. 150 hp. at 1800 rpm. Other models from 33 hp. to 325 hp.*



HOW SISALKRAFT DOES 2 JOBS FOR THE COST OF 1



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Tough, waterproof SISALKRAFT laid over the freshly set slab seals in the water of the mix—assures a perfect cure and hard, dense concrete, comparable to concrete cured by complete water immersion. No sprinkling required. No sand, straw, burlap or tarps. No watching.

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SISALKRAFT is amazingly strong and rugged. It protects the surface from debris, drip and damage. Work can proceed efficiently right over the paper, without injuring the finished floor. Saves time and labor—eliminates grinding and cleaning up the finished job.

SISALKRAFT is being used on concrete highway jobs from coast to coast — for curing airport runways — floors in single story or skyscraper buildings—for concrete work of all types. It is showing substantial savings in costs and time.

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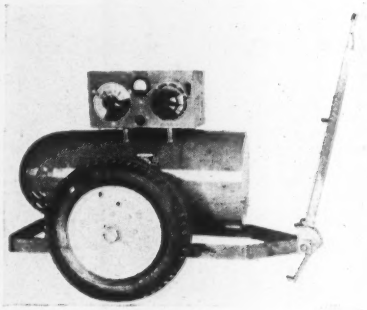
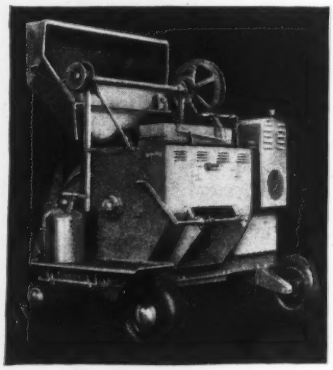
graphed directly on the sensitized surface saving time in template making. The process is said to be suited for name plates, instrument dials, etc., and can generally be produced overnight. The process is available to organizations for their own producing work. Photographers are being appointed in various sections of the country to do the work commercially. —*Republic Engineering Products, Inc., 480 Lexington Ave., New York City.*



Welding Machine Trailer

A new two-wheeled light-weight pneumatic-tired trailer for mounting arc welding machines for easy, fast portability in shop, yard or on the road, is designed for mounting either Lincoln SAE 200 to 600 amp. a.c. motor driven or Type SA 200 special engine driven Lincoln arc welders. The unit can be used for road towing up to approximately 30 mph.—*Lincoln Electric Co., Cleveland, Ohio.*



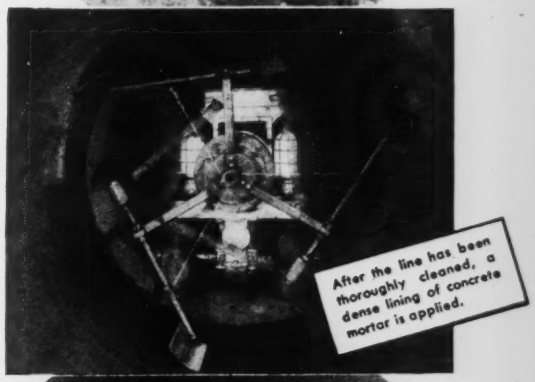
Bituminous Mixer

A new and larger size bituminous mixer has been added to Kwik-Mix group of bituminous mixers. It is designed for service in maintenance departments of states, counties and municipalities, as well as for contractors who pave driveways, parking lots, etc. The mixer is adaptable for all standard types of cold-laid mixtures of cut-backs, asphalt, tar, emulsions and powdered asphalts where aggregates are mixed at atmospheric temperature and the heat required for the bituminous material does not exceed 175 degrees.—*Koehring Co., Milwaukee, Wis.*

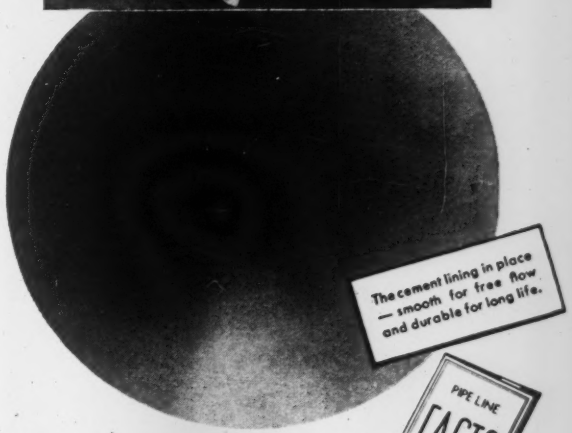
WE NEED NO PRIORITIES

. . . to restore the carrying capacity of your pipe line . . .

Here is the corroded and tuberculated line before cleaning.



After the line has been thoroughly cleaned, a dense lining of concrete mortar is applied.

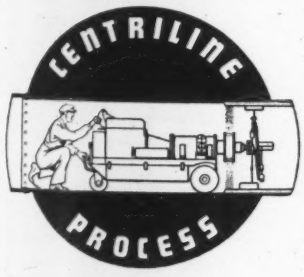


The cement lining in place — smooth for free flow and durable for long life.

There's no priority problem here—and we have an answer to your question "How can we get more water without installing new mains"?

The answer is "Centrilining". The only materials needed are sand, cement and water, for this process consists of cleaning the old main thoroughly to remove tubercles and incrustations, then applying a rich, dense lining of cement mortar by centrifugal force and mechanically trowelling it to a smooth finish.

The results? A smooth, clean pipe line having permanently high carrying capacity and lower pumping costs, plus lasting protection against corrosion and tuberculation — and at a fraction of the cost of a new pipe line.



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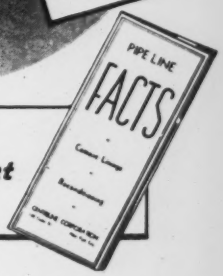

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If you want to make speed profitably
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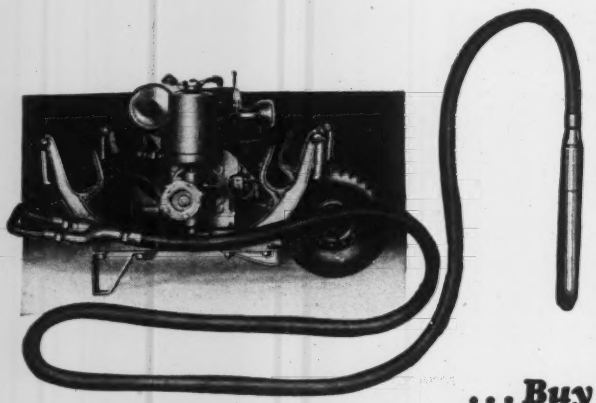

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Powerful gas engine—4.7 H.P.

Long-lived, ball-bearing, rotary, hydraulic pump.

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BALANCED WHEELBARROWS FOR ALL PURPOSES

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Standard Barrow Has Steel Wheels

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Butt-Welded Rod in Top Edge of Trays

Furnished With Solid Rubber or Pneumatic Tires as Shown

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1200' assembled pipe (132 Tons) were lowered to bed of Mississippi at St. Paul with 9—5-Ton Beebes, three lines to each hoist through blocks.
Hudson River Bridge sidewalks were laid in sections with 32—5-Ton Beebes.
Longest wooden trusses in world were installed with ONE 5-Ton Beebe after power hoists proved impractical.

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When raising, lowering, or placing costs by power are a serious problem, the answer is the right number of Beebe Bros. All Steel Hand Hoists MANNED IN UNISON. Available in 2, 5 and 15 Ton sizes. Sold through leading dealers in all trade centers. List of dealers sent upon request.

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"THE STRONGEST GEARED POWER FOR ITS WEIGHT IN THE WORLD"

NEW PUBLICATIONS

Air Cleaners—The 25th Anniversary Book of the Donaldson Co. describes the pioneering achievements in commercial air cleaners for internal combustion engines and describes their present construction and application to the many machines now operated on construction. —*Donaldson Co., Inc., 66[illegible] Pelham Blvd., St. Paul, Minn.*

Safety—"Protection for the Eyes and Face" is the subject of a four-page circular featuring twenty different models of face shields.—*The Boyer-Campbell Co., 6540 Antoine St., Detroit, Mich.*

Cable Lubricant—Valvoline cable compound is described in a sheet which gives information on lubricating cables and wire rope.—*Valvoline Oil Co., Cincinnati, Ohio.*

Jacks—Jacks in innumerable types to multiply manpower, relieve busy cranes and other handling equipment, and to simplify many jobs now being done the hard way, are shown in the new Junior Catalog No. 41. Recently revised price schedules are also given.—*Templeton, Kenly & Co., Chicago, Ill.*

Prefabricated Housing—To provide equipment housing ideas for the design engineer, a new four-page, two-color house organ is being published by the manufacturer of Lindsay Structure prefabricated all-steel housings. Design engineers and others interested may be placed on the mailing list by request.—*Dry-Zero Corp., Lindsay Structure Division, 222 North Bank Drive, Chicago, Ill.*

Paver—The Koehring 34E Twinbatch Paver is the subject of a profusely illustrated and adequately descriptive bulletin which gives full information about this large paver and the general theory of two-drum mixers.—*The Koehring Co., Milwaukee, Wis.*

Gypsum Sheathing — A new booklet contains complete information on the qualities of gypsum sheathing, including its fire-resistance strength, durability, total lack of shrinkage, weather and water-resistance, low cost, and availability. Gypsum sheathing is said to be the only fireproof sheathing material on the market.—*Gypsum Association, 211 West Wacker Drive, Chicago, Ill.*

Electric Drill—"The Fast, Modern Way to Drill" is the title of a new bulletin giving six pages of information and specifications on the THOR ¼-in. portable electric drill. Request Circular No. JE-112.—*Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago.*

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With replacement parts at a premium, it's more important than ever to get the longest possible service life out of vital wearing surfaces. That's why so many manufacturers are relying on the Airco Flame Hardening Process to do just that. For this proved process increases the life of wearing parts immeasurably by hardening the surface — yet the core retains its original toughness and shock-resistance. Sprockets, gear teeth, wearing surfaces, shafts and a multitude of shapes regardless of size, are quickly and economically hardened for longer life this modern Airco way.

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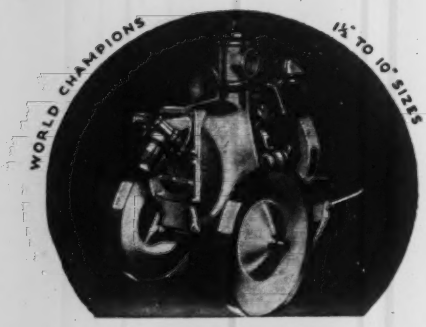

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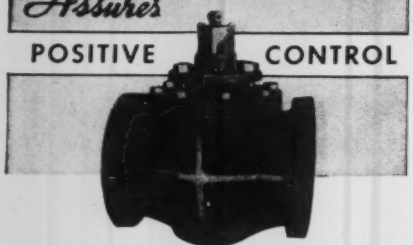

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The Nordstrom method of "Sealdport" lubrication assures positive valve operation and control on sewage disposal plant lines. Nordstrom lubricant, under high pressure, is forced between the plug and body, making the valve leak resistant and freeing the plug to assure easy operation. By simply turning a screw at the top of the valve, both seat and plug surfaces are covered with a film of lubricant and a perfect seal is effected. Nordstrom Lubricated Valves have proven that they will outlive the average valve several times over on sewage disposal services.

MERCO NORDSTROM VALVE COMPANY
PITTSBURGH EQUITABLE METER COMPANY

Manufacturers' Activities

J. W. COLGAN, formerly manager of Handy & Harman of Canada, Ltd., Toronto, has been called back to New York in the capacity of sales manager of the parent company, Handy & Harman, dealers in precious metals.

REPUBLIC STEEL CORP. has announced that M. A. Wick resigned, effective July 1, as a director and vice president in charge of finance. Mr. Wick, 78, was president of Steel and Tubes, Inc., now a part of Republic, and joined Republic in 1930 as assistant to the president.

SULLIVAN MACHINERY CO., Michigan City, Ind., announces the retirement on pension of Howard T. Walsh as of June 30, after 41 years of continuous service.

COPPERWELD STEEL CO., of Glassport, Pa., has announced the election of Thomas F. Troxell as treasurer and a director. He has been a partner of the investment banking firm of Riter & Co., New York. Sidney D. Williams, formerly vice president in charge of steel sales, has been made executive vice president in charge of the Warren, Ohio, division. William B. Klee, Jr., assistant secretary, has also been made assistant to the executive vice president. C. Walter Holmquist, formerly general superintendent, has been made vice president in charge of plant operations, Glassport division.

CARNEGIE-ILLINOIS STEEL CORP., Pittsburgh, has announced the appointment of Delbert B. Geeseman as general superintendent of Canonsburg Works, the tin plate manufacturing plant recently acquired by Carnegie-Illinois from Standard Tin Plate Co.

N. O. CRUVER, who has been with the Wheeler Osgood Sales Corp. of Tacoma, Wash., and New York City, producers of doors and plywood, for 23 years, was recently elected vice president and general manager of the company, succeeding D. J. Young, retired.

LLOYD W. WEED, formerly of the Portland Cement Association, has joined the staff of the Wait Associates, Inc., New York City, sole representatives of Rosendale natural cement.

LINK-BELT CO., Chicago, has announced that F. V. MACARTHUR, after nearly 50 years of service, has resigned as secretary and assistant treasurer of the company and is retiring from business. HARRY E. KELLOGG, treasurer and assistant secretary, has been elected secretary, thus suc-

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NR × 28-41

ceeding Mr. MacArthur. MELBOURNE P. ANDERSON, formerly general accountant, has been appointed assistant treasurer, and HENRY C. OAKES, statistician, to the position of assistant secretary. FRANK H. BRANDT has been appointed general auditor in charge of the accounting of the company.

RANSOME CONCRETE MACHINERY CO., Dunellen, N. J., has appointed the Highway Machinery & Supply Co. Inc., 1724 Altamont Ave., Richmond, Va., exclusive distributor in the state of Virginia to handle their complete line of construction equipment.

ROBERT B. WHYTE was recently made vice-president in charge of operations of Macwhyte Wire Rope Co., Kenosha, Wis. A graduate of Cornell, Mr. Whyte became wire mill superintendent of Macwhyte Co. in 1917, has since served as general factory superintendent and was elected a director in 1937.

J. B. WALKER has been appointed sales manager of the transportation and generator division of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., succeeding RALPH O. WATSON, who died last May. A. C. MEIXNER will take Mr. Walker's place as manager of the generator section.

CHAIN BELT CO. of Milwaukee has just announced that J. WALTER SNAVELY, district manager in the Houston territory for seven years, has returned to the sales department of the conveying and engineering products division at Milwaukee. W. A. PITTS, formerly representative in Oklahoma City, has been appointed district manager of oil well sales at Houston. GEORGE HUNT has been appointed district manager of industrial sales with headquarters at Dallas, Tex.

WILMOT SANDHAM has been appointed service manager of H. O. Penn Machinery Co., distributors of Caterpillar and allied construction equipment lines. He will have complete supervision over all service and parts departments, not only at the Manhattan headquarters but also at the company's Mineola, L. I., and Poughkeepsie, N. Y., branches, and the parts depot at Lackawack, N. Y.

BROOKS EQUIPMENT & MFG. CO., Knoxville, Tenn., has announced the death of Mr. Lew Wallace Brooks, president of the company.

WORTHINGTON PUMP & MACHINERY CORP., Harrison, N. J., has appointed CARLETON REYNELL as general manager of purchases and traffic, FREDERIC W. THOMAS as assistant general manager of purchases, and DEAN K. CHADBOURNE as assistant general manager of traffic.

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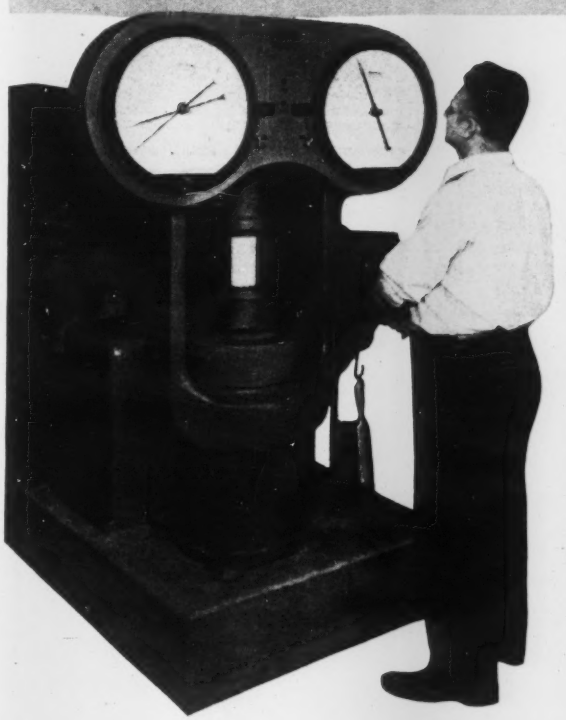

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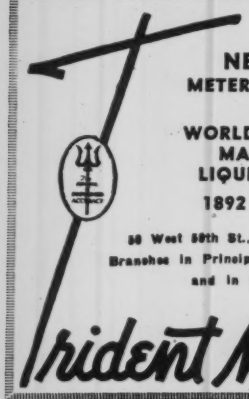

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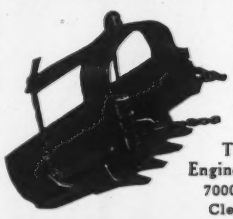

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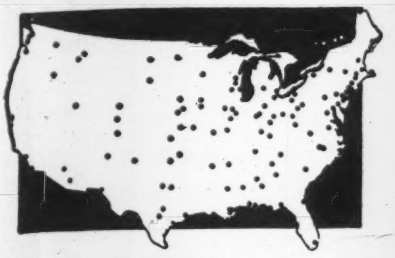

Symbols and Abbreviations Include:

† Federal Government
★ Project of $500,000 or over
ENR Engineering News-Record
CD Engineering News-Record Construction Daily

Projects—By Size

Construction projects here reported cover the United States and Canada, are of these minimum sizes or larger; water supply, earthwork, waterworks, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

Classes of Construction

(Named in order of Listing)

Water Supply
Sewers, Waste Disposal
Bridges, Grade Cross'gs
Streets & Roads
Earthwork, Waterways
Unclassified
Latin America
Public Buildings
Commercial Buildings
Industrial Buildings

Stages Reported

PROPOSED: (except Streets & Roads):

BIDS ASKED (new announcements only. For full calendar, see also preceding issues of ENR);

LOW BIDDERS: All low bidder news will be the final reports published on the projects involved except where award is not made to the low bidder. In this case, a supplementary contract award report will be published.

CONTRACTS AWARDED: Except awards to low bidders previously reported in low bidder stage.

Dates shown are of issue in which last previous report was published.

WATER SUPPLY

PROPOSED WORK

Ala., Phoenix City—Waterworks sys. $150,000. J. W. Goodwin Eng. Co., Martin Bldg., Birmingham, engr.

Calif., Madera—City voted bonds $27,000 for water sys. extens. CD 8/6—ENR 8/14.

Ill., Bellevue (P. O. Peoria)—Pumping station, take water from Peoria, elevated tank, watermains and appurtenances. Russel & Axon, Roosevelt Bldg., Delmar and Euclid Avenues, St. Louis, Mo., engrs. CD 3/6—ENR 3/13.

Ill., Brimfield—Imprv. reservoir water purification, softening plant, distr. sys., storage reservoir, pressure tank, and appurtenances. Over $15,000. Austin Engineering Co., Peoria, engrs.

Ill., Carbondale—C. Johnson, mayor, 3½ mi. watermain, Crab Orchard Lake to Municipal WW sys. **$65,000.** Day labor.

Ill., Christopher—L. Hileman, mayor, 6 mi. watermain, obtain water supply from Big Muddy River, pumping sta. on river. $30,000.

Ill., Mackinaw—Town, imprv. water supply sys. $15,000.

Ill., Moline—c/o City Clk., 14,180 ft. 18 in. watermain, pumping station to reservoirs, 17 St. and Miss. River, elevated steel tank, 36 St. and 23 Ave., addnl. 10 and 12 in. mains, automatic screen bldg. at pumping station. $400,000. Applied PWA funds.

Ill., Peoria Heights—City, 2 new wells, exten. distr. sys., etc. Over $15,000. Austin Engineering Co., Peoria, engrs.

Ill., Taylorville—Artificial lake for Water supply $750,000 to $2,750,000. Warren & Van Pragg, Decatur, engrs.

Ind., Holland—Town, to vote on bond issue WW sys. $50,000.

Kans., Rossville—WW sys., $20,000. Paulette & Wilson, Topeka, engrs.

Ky., Louisville—Louisville Water Co., 435 S. 3 St., lines and connectioons to district, serving 300 homes, etc. $150,000.

Mass., Rockland—Bd. Selectmen, Town Hall, con., brick, pumping station, equip., Accord Pond. Over $15,000.

Mich., Lansing—Bd. Water & Light, addn. turbine generator to Lansing Municipal Power Sys. $37,000.

Miss., Waveland—Voted bonds WW. imprvs. $125,000. F. P. Joseph, Glenmora, La., engr.

Nebr., Plattsmouth — Extensions water mains, approx. $100,000. Henningson Engr. Co., Standard Oil Bldg., Omaha, engr.

N. Y., Waterloo—Town Water Dist., water supply sys. $50,000. S. Lozier, Inc., 10 Gibbs St., Rochester, engr.

N. C., Concord—E. E. Deal, mayor, voted $405,000 bonds, WW sys., sewers, streets, etc. CD 7/15—ENR 7/17.

Okla., Choteau—WW sys., distr. mains. $25,000. T. P. Clonts, Muskogee, engr.

Pa., Scranton—Scranton Spring Brook Water Service Co., Jefferson Ave., exten. water mains. Over $25,000.

S. D., Sioux Falls—WW. imprv., increase in filter capacities, well construction. $75,000.

Tex., Grand Prairie—WW. addns. $60,000. H. Smith, 2151 Fort Worth St., Dallas, engr. CD 8/7—ENR 8/14.

Tex., Harlingen—Storm sewerage sys. $100,000. A. Tamm, Harlingen, engr.

Tex., Orange—A. Sokoloski, mayor, sewage disposal plant and sewerage sys. imprvs. $137,046. Applied for PWA funds. C. P. Smith, Orange, engr. CD 7/28—ENR 7/31.

Tex., Weatherford — WW sys., extens., imprvs., $46,338. S. M. Field, engr.

★**†Va., Norfolk**—City of Norfolk, earth dam, spillway and accessories, incl. connection with new reservoir and Lake Prince, constructing main pipe line from existing pumping station to Lake Prince to city pump station, Docket 44-101. $2,240,500. **FWA.**

Wash., Kirkland—City, wells, and water sys. $33,500. Applied PWA funds.

Wash., Omak—Drilling well, pumping station, 12 in. pipeline from pumping station across Okanogan River to Fifth Ave. S. $60,000.

Wash., Port Townsend—Small dams, Lord's Lake water reservoir, pipe line, etc.

Wash., Puyallup — East Woodland Water Dist., WW sys. Parker & Hill, Smith Tower, Seattle, engr.

Wash., Seattle—City, County-City Bldg., rejected bids August 7, 2,180 ft. 51½ in. steel pipe for watermain replacement. $25,000. CD 8/13—ENR 8/21.

Wash., Spokane—Rein.-concrete reservoir, 10 Ave. and Southeast Blvd. bids in spring. $300,000. A. W. Lindsay, City Hall, water supt.

Alta., Fort Saskatchewan—WW sys. $20,000.

Que., Drummondville — Collector sewer to drain basin of 46 acres, exten. other sewers. $25,000.

BIDS ASKED

Bids Asked September 22

Ia., Pauline—G. W. Harris, clk., 100,000 gal. reservoir, well, imprv. pump house, addn. piping for pump house, motor driven turbine pump. Buell & Winter, Sioux City, engr.

LOW BIDDERS

Mass., Brookline—Water Dpt., 329 Washington St., Aug. 22, 1 story, 37x48 ft. brick meter bldg., from Tocci Brothers, Inc., 38 Colonial Ave., Newtonville. $19,400. CD 7/31—ENR 8/7.

Vt., Brattleboro — Town, Bd. Selectmen, Town Hall, 2.7 mi., 10 in. c.i. water pipeline, 400 ft. bridge crossing, from A. E. Bragger Constr. Co., Greenwood, R. I. $44,705. Est. $52,000. CD 8/25—ENR 7/17.

CONTRACTS AWARDED

Mich., Highland Park (Br. Detroit)—Wayne Co. Road Comn., Barlum Tower, Detroit, water mains and sewers in connection with depressed highway Davison Ave., to Waterway Constr. Co., 22240 West Eight Mile Rd., Detroit. **$40,030.** Bids 8/4. CD 8/11.

N. Y., New York—Dpt. Water Supply, Gas & Electricity, Municipal Bldg., exten. and imprv. water mains. WPA. **$417,274.** W. W. Johnstone, 70 Columbus Ave., dir. div. operations.

†N. C., Jacksonville—Farm Security Administration, Raleigh, water and sewer utilities for trailer camp, to J. M. Gregory, Box 721, Raleigh. **$25,081.** Bids 8/1.

Pa., York—York Water Co., W. F. O. Rosemiller, pres., 6 new filter units, filtration plant, separate contracts. **$75,000.** CD 8/12—ENR 8/14.

†Tex., Brownwood—Con. Q. M., Fort Sam Houston, 1,000,000 gal. water reservoir, Camp Dowie, to Hickey & Co., Construction Bldg., Dallas. **$55,860.** CD 4/29—ENR 5/1.

†Tex., Fort Worth—U. S. Eng., Denison, steel water storage tank, to Virginia Bridge & Iron Wks., Electric Bldg., Fort Worth. **$26,500.**

Ont., Fingal—Dpt. Natl. Defense for Air, Ottawa, 6¾ mi. 6-in. water mains from Port Stanley to No. 4 Bombing and Gunnery School, to Scott-Jackson Constr. Co., Ltd., 57 Bloor St. W., Toronto. Est. **$75,000.** CD 7/28—ENR 7/21.

SEWERS, WASTE DISPOSAL

PROPOSED WORK

Ala., Sheffield—Sanitary sewerage sys., waterworks, $300,000. J. W. Goodwin, Eng. Co., Martin Bldg., Birmingham, engr.

Calif., Berkeley—163 lin. ft. 18 in. vitr. storm sewer, manholes, catchbasins.

Calif., Carmel—Carmel Sanitary Dist., Sundial Court Apartments, Carmel, 1,246 lin. ft., 6 in. vitr. sewers with laterals, brick, con. manholes, flushing inlets, tee branches, etc., C. C. Kennedy, 604 Mission St., San Francisco, engr.

Calif., Fresno—Sewers in Clifton Terrace and Sierra Vista Addn. Over $25,000. City Eng. Dpt., City Hall, engrs. CD 3/5—ENR 3/13.

Calif., Madera—City, voted bonds $25,500 for extens. sewer sys. CD 4/29—ENR 5/1.

Calif., Mill Valley—Sanitary Dist., construct outfall interceptor sewers, treatment plant. $200,000.

Calif., Walnut Creek—Surveys sewerage sys., in Pringle addn, $25,000. C. P. Martin, town engr.

★**Conn., Stamford**—City Hall, sewage disposal plant, incinerator, trunk sewers. $1,000,000. W. Raisch, 227 Fulton St., New York, consult. engr. M. Solomon & Keis, 257 Broadway, Troy, New York, engr.

Ia., New London—Sewers, sewage disposal plant, $100,000. Stanley Engineering Co., Muscatine, engr.

Ia., Shenandoah—Storm sewers. $40,000. Applied WPA funds.

†La., Leesville—City of Leesville, exten. sewerage sys. and constructing sewage treatment plant, Docket 16-101. $424,596. **FWA.**

Maryland—Baltimore Co. Comrs., Court House, Towson, sewage sys., treatment plant, $247,500. Filed application for grant. sanitary sewers and pumping stations, $165,000.

★**Mich., Detroit**—Dpt. P. Wks., City Hall, exten. Southfield sewer from Michigan Ave. to disposal plant, incl. 4 mi. of 10 ft. inside diam cylindrical concrete pipe, etc., to relieve pollution Rouge River. $3,110,000. G. R. Thompson, City Hall, engr.

Mich., Frankenmuth—Plans by Francis Engineering Co., Saginaw, sewage disposal plant.

Minn., Kelly Lake—Stuntz Township, sewage disposal plant, $70,000. C. Foster, 316 Medical Arts Bldg., Duluth, engr.

Minn., Wheaton—$50,000 bond issue voted, sewage disposal plant. Est. cost. $100,000. WPA. CD 8/6—ENR 8/14.

★**Neb., Papillion**—Sarpy County, sanitary sewers from North County Line to Fort Crook Bombing plant, etc. $500,000. Henningson Engr. Co., Standard Oil Bldg., Omaha, engr.

N. J., Bayonne—Excavating, sheathing, 6 and 10 in. vitr. tile sewers, various streets, $55,000. H. A. Jaeger, City Hall, WPA and City engr.

N. J., Passaic Twp.—Twp. Hall, Stirling, excavating sanitary sewers, various streets, $56,600. C. Malstrom, Orange and N. 6 Sts., Newark, WPA and owners, engr.

N. C., Morehead City—Town, D. B. Willis, mayor, sewer line extens., suburban areas. $300,000. Applied PWA funds.

O., Medina—Village, vote $65,000 bonds in November, repair sewer sys., disposal plant.

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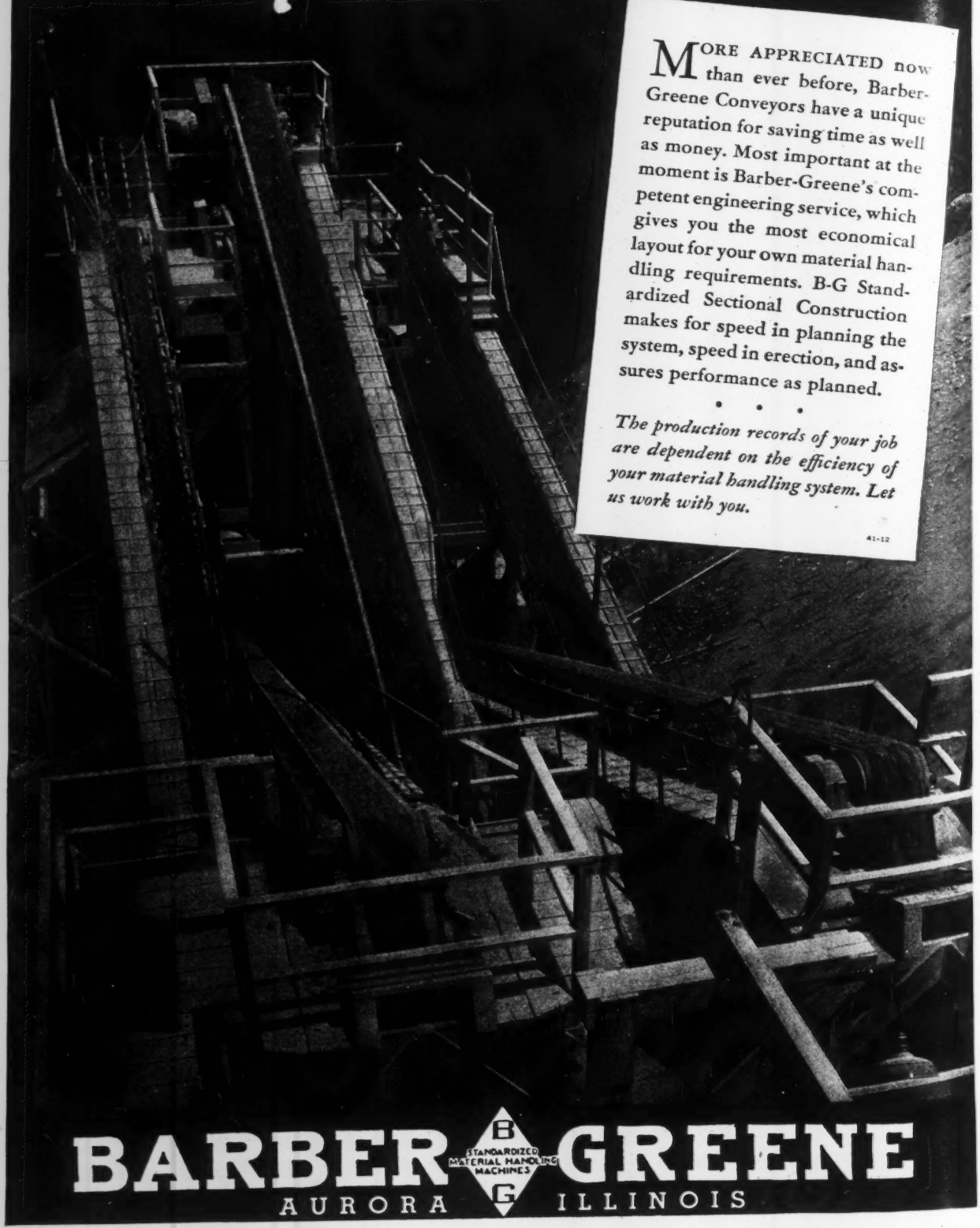

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SEWERS, etc. (Proposed Work, Cont'd.)

Ore., Eugene—Pumphouse, chlorinator bldg., equip., bldg., large settling tank and digester bldg., $125,000 available. PWA may be asked for balance. L. R. Stockman, Baker, engr.

Pa., Freemansburg—Borough Council, sanitary sewer to connect with disposal plant, Bethlehem. $50,000.

Tex., Corpus Christi—A. C. McCaughan, mayor, 150 ton incinerator. $174,600. Applied for Federal funds.

Tex., Pasadena—Impv. sewage collecting sys. $210,000. Garrett Eng. Co., 3504 Audubon St., Houston, engr.

Tex., Weatherford—Sanitary sewerage sys., exten., imprvs., $63,934. S. M. Field, engr.

Wash., Bellevue—Sewer sys. $70,000.

Wash., Seattle—King Co., sewer sys., sewage treatment plant, View Ridge Dist., $217,030. H. J. Sisler, County-City Bldg., engr.

Wash., Seattle—King Co., sewers in Pipers Canyon-Oak Lake $350,000, Maple Leaf $290,000, Ravenna $40,000, Lake City $250,000, Lake Burien $390,000, White Center $300,000, Des Moines $20,000. H. H. Sisler, co. engr.

Wis., Waupun—City, imprv. sewage treatment facilities.

Ont., Peterboro—City, 3 burner refuse incinerators. $42,000. R. H. Parsons, c/o owner, engr.

BIDS ASKED

Bids Asked September 2

N. Y., Astoria—Dpt. P. Wks., Municipal Bldg., New York, Contr. 4A, grit chamber superstructure, Bowery Bay Sewage Treatment Wks.

Pa., Scranton—Lackawanna Co., sewage disposal plant at West Mountain Sanitarium. Over $25,000.

Bids Asked about September 10

Tex., Wichita Falls—Sewer extens. and imprvs. $25,000. F. M. Rugeley, Wichita Falls, engr.

LOW BIDDERS

O., Macedonia—Dpt. P. Welfare, State Office Bldg., Columbus, sewers and sewage disposal plant, Hathornden State Hospital, from Domenic Nero Constr. Co., 1424 Lakewood Ave., Cleveland. $56,950.

CONTRACTS AWARDED

Calif., San Bernardino—Lakewood Village P. Utility Dist., 15,000 ft. 24 in. vitr. clay pipe sewer, 3 pumping stations, to J. S. Barrett, Campo, **$100,397.** Currie Engineering Co., Anderson Bldg., San Bernardino, engr.

Colo., Grand Junction—City, sewers, sewage disposal plant, watermains, WPA labor. **$36,000.**

Ill., Freeport—G. Loveland, city clk., sanitary sewer, sys., northwest sect. city, to E. M. Rocho. **$30,540.** CD 7/31—ENR 8/8.

Ia., Des Moines—Polk Co., exten. sewers to county farm, to Hoak Constr. Co., 621-63 St. **$27,608.** CD 3/6—ENR 3/14.

†N. J., Clark—Federal Works Agency, Wash., D. C., 4- to 18 in. vitr. tile sanitary sewers for defense housing project, WPA. **$55,500.**

N. J., Freehold—Monmouth Co., Court House, Freehold, excavating, drainage ditches along meadows, WPA. **$56,890.** W. D. Cougle, 1102 S. Broad St., Trenton, WPA and owners, engr.

N. J., Hammonton—Atlantic Co., Court House, Atlantic City, excavating, drainage sys., various streets, WPA. **$70,165.** G. R. Swinton, 930 Atlantic Ave., Atlantic City, WPA and owners, engr., CD 7/14—ENR 7/17.

N. J., Long Beach Twp.—Excavating, sanitary sewers on various streets, beach erosion control, WPA. **$58,436.** W. D. Cougle, 1102 S. Broad St., Trenton, WPA and owners, engr. CD 7/16—ENR 7/24.

N. Y., Brooklyn—President Brooklyn Boro, Boro Hall, storm, sanitary and combined sewers at West St. and Ave. W and East 53 St. from Aves. L to M, WPA. **$72,564.** W. W. Johnstone, 70 Columbus Ave., New York, N. Y., dir. Div. Operations.

N. Y., Brooklyn—President Brooklyn Boro, Boro Hall, storm, sanitary and combined sewers, WPA. **$62,760.** W. W. Johnstone, 70 Columbus Ave., New York, dir. Div. Operations.

O., Bethel—Complete sewage and waterworks sys., WPA. **$340,000.** A. LeFeber, American Bldg., Cincinnati, engr.

Tenn., Etowah—City, c/o F. M. Coutrell, mayor, storm sewers, WPA. Est. **$90,000.**

BRIDGES GRADE CROSSINGS

PROPOSED WORK

Calif., Nicolaus—State Engineer, Div. Water Resources, P. Wks. Bldg., Sacramento, rejected bids July 9, rein.-con. girder spans as repairs to existing bridge, Feather River. CD 1/17—ENR 7/24.

†Idaho—Public Roads Admin., Ogden, bids soon steel bridge, Warren Wagon Rd.

Ia., Davenport — City, bridge over Black Hawk Creek, also 2 bridges over Duck Creek, one on Jersey Rd., other on Eastern Ave. Consoer, Townsend & Quinlan, 211 W. Wacker Dr., Chicago, Ill., engrs.

Missouri—State Hy. Comn., Jefferson City, rejected bids received July 25, three 25 ft. continuous slab, Scott Co. CD 7/15.

Oklahoma—State Hy. Dpt., V. T. Moon, engr., Capitol, Oklahoma City, overpass over Frisco lines on State Hy. south Chandler. $35,000.

Tex., Orange—Rein.-con. bridge. $75,000. C. P. Smith, Bancroft Bldg., Orange, engr.

Tex., Pecos—Reeves Co., Pecos River Bridge, approaches, embankment, concrete retaining wall, grading, etc. $45,697. A. W. Pope, Monahans, engr.

★**Washington**—Kitsap Co., 2,000 ft. bridge, 1,500 ft. approaches, over Port Washington Narrows, between Bremerton, and Manette. $1,250,000.

Wash., Bremerton—City, overpass at approach to Manette Bridge. $250,000. Federal funds sought.

★**Wash., Mount Vernon**—Skagit Co., Courthouse, Mt. Vernon, 5 bridges. $1,000,000. H. Walberg, Courthouse, Mount Vernon, engr.

★**Wash., Wenatchee**—State Hy. Dpt., Olympia, bridge over Columbia River, $1,000,000. B. Bantz, State Hy. Dir., Olympia, engr.

B. C., Chilliwack—P. J. Brown, municipality clk., reconstructing bridge, Vedder Crossing. $30,000. Dpt. P. Wks., Victoria, engrs.

B. C., Victoria—Provincial Government, Victoria, steel bridge, Goat River. $30,000. A. Dixon, c/o Dpt. P. Wks., engr.

Quebec—Province of Quebec, Quebec City, 4 bridges over Duchesne, Nicolet-St. Francis and Becancourt Rivers, on Drummondville-Quebec Hy. $150,000. O. Desgardins, Dpt. P. Wks., Quebec City, engr.

BIDS ASKED

Kan., Kansas City—Wyandotte Co., repairing James St. Bridge over Kaw River, $145,000, Change of date, Sverdrup & Parcel, Railway Exch. Bldg., St. Louis, Mo., engrs. Mr. Ellerbrook, Court House, co. engr. CD 8/6—ENR 8/14.

Bids Asked September 3

Connecticut—State Hy. Comn., W. J. Cox, State Office Bldg., Hartford, concrete filled steel grid flooring bridge over Farmington River, Route 5a, Windsor; 2 T beam bridges, Sandy Brook Rd., and 2,857 ft. traffic bd. gravel, Colbrook.

N. J., West Paterson—Bd. Freeholder, Passaic Co., Administration Bldg., Paterson, Jackson Ave. br. over Peckman River, G. Ferguson, Administration Bldg., Paterson, engr.

Bids Asked September 5

Alabama—State Hy. Dpt., Montgomery, extended date, concrete arch culverts and timber bridges on roads FAP-269-A(1), and FAP-440-B(1), FASO109-A(1), Sn-FAP-147-A(2). CD 8/13.

Missouri—State Hy. Comn., Jefferson City, three 25 ft., rein.-con. slab spans over Drainage Ditch 1, Route 60, Scott Co.; three 10 ft., rein.-con. slab spans over stream, Ripley Co.; four 40 ft., rein.-con. deck girder spans over Shoal Creek, Barry Co.; one 78 ft., two 67 ft. and three 57 ft., steel, I-beam and plate girder spans over Moniteau Creek, Bonne-Howard Counties; one 49 ft. and four 31 ft. I-beam spans over north fork South Fabins River, Adair Co.; two 10 ft., rein.-con slab spans over Muddy Creek, Harrison Co.; three 25 ft. I-beam spans over McGuire Branch, also 20 ft., rein.-con. slab span over Roger Branch, both Clinton Co.

Bids Asked September 9

Maryland—State R. Comn., Federal Reserve Bank Building, Calvert and Lexington Sts., Baltimore, rein.-con. substructure, bridge over Potomac River, connecting Washington Co., Md., and Loudoun Co., Va., at Sandy Hook, Md., Maryland-Virginia FAP E. R. H.-1-A-(1), Washington Co.; adv. ENR 8/25.

Pa., Pittsburgh—Allegheny Co., widening Bridge 5, Lowries Run, Ohio Twp. Levi Burd Duff, County Office Bldg., engr.

Bids Asked September 10

California—C. H. Purcell, state hy. engr., P. W. Bldg., Sacramento, Humboldt and Siskiyou Counties, remove and salvage 2 bridges, one at Robinson Ferry and one North Scotia, Humboldt County, bridge with salvaged steel, Salmon River, Somes Bar, Siskiyou Co.

LOW BIDDERS

D. C., Wash.—Dist. Comrs., Wash., D. C., Aug. 19, 2 bridges, in line South Capitol St. at Oxon and Southern Ave., from Cayuga Constr. Co., 30 Vesey St., New York, N. Y. $54,969. CD 8/5—ENR 8/7.

Maryland—State Roads Comn., Baltimore, railroad grade separation, approaches, Arundel and Howard Counties, from Ehrhardt & May, 5723 Harford Rd., Baltimore, **$171,404.** CD 8/11—ENR 8/14.

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BRIDGES, etc. (Low Bidders, Cont'd.)

Minnesota—State Hy. Dpt., St. Paul, August 8, bridge 5947, Benton and Stearns Counties, over Mississippi River, between Sauk Rapids and St. Cloud, from Minneapolis Bridge Constr. Co., P. O. Box 1143, Minneapolis, $167,182. CD 7/22—ENR 7/24.

★**New Jersey**—E. D. Sterner, comr., State Hy. Dpt., Sheesequake Creek Bridge, Rt. 35, from Fehlhaber Tile Co., 205 E. 42 St., New York, $942,893. CD 8/5—ENR 8/7.

CONTRACTS AWARDED

Ill., Joliet—Will Co., 2 bridges over co. rds., to Powers-Thompson Constr. Co., 37 S. Chicago St. **$31,549.**

Massachusetts—Dpt. P. Wks., H. L. MacDonald, Comr., 100 Nashua St., Boston, bridge and approaches, Becket, to Graves & Hemmes, Inc., 105 Main St., Great Barrington, Mass. **$114,075.** CD 6/18—ENR 6/27.

Neb., Omaha—Douglas Co., county bridges, to Western Bridge & Constr. Co., 3867 Leavenworth St., Omaha. **$27,336.**

Va., Great Bridge (mail Norfolk)—V. S. Eng., 1st and Douglas Sts. N.W., Wash. D. C., highway bridge, to Carpenter Constr. Corp., Bank Commerce Bldg., Norfolk, Va., **$214,812.** Bids 7/30. CD 7/25.

Wyoming—Wyoming Hy. Comn., F. Kelso, supt., Cheyenne, rein.-con. deck girder bridge, rein.-con. culvert, 8.049 mi., Hanna-Rock River Rd., to Wyoming Construction Co., Box 717, Laramie. **$28,576.** CD 8/8—ENR.

STREETS AND ROADS

BIDS ASKED

Bids Asked September 2

Ill., Lincoln—Paving 0.3935 mi., Sect. 12-CS, storm sewers, etc. G. H. Baker, Centennial Bldg., Springfield, state engr. co. rds., city sts.

Ill., Oak Park—Bituminous concrete surfacing, 46,000 sq. yd., concrete base, 19,000 sq. yd., etc., Sect. 25 C-S.

Bids Asked September 3

Calif., San Francisco—A. Boyd, State archt., P. W. Bldg., Sacramento, 292,000 sq. ft. liquid asphalt, 2 coats, and 1 coat screenings, Livestock Pavilion & Grounds, Agric. Dist. 1-A.

Connecticut—W. J. Cox, comr., State Hy. Comn., State Office Bldg. Hartford, bituminous macadam, 5,160 ft., sect. Short Beach Rd., Rt. 142, Branford; 4,194 ft. sect. West Simsbury Rd., Simsbury; 5,526 ft., Floydville Rd. and Holcomb St., East Granby; RBR graveling, 5,043 ft., Bigelow Hollow Rd., Union; 9,350 ft., Whale Hd. Rd., Center Groton Rd. and Iron St., Ledyard; 20,257 ft., various town roads, and drainage work 950 ft., Trumbull-Shelton; Rein. con., 2,993 ft., North St., Greenwick; loose rock and appurtenant work approach Merrit Pkwy, Rt., 8, Stratford.

Ill., Chicago—Cook Co. concrete paving, seven sect. 12,500 sq. yd. ea.

Kansas—State Hy. Dpt., Topeka, asphalt surface treating 13.094 mi. K 6690, Grant Co., 14.435 mi. K6689 Greeley Co., 13.913 mi. K 6688 A.B. Clark Co., 13,111 mi. K6692, Stevens Co., 19.418 mi. K6691, Hamilton Co., 13.111 mi. K 6692, Stevens Co.

N. J., Lawrenceville—Lawrence Twp., Twp. Hall, penetration macadam on macadam surfacing, 4,155 sq. yd., Princeton Pike., Sect. 4. Bids Aug. 6 rejected. B. F. Stratton, Broad St. Bank Bldg., Trenton, engr. CD 7/24—ENR 7/31.

Washington—Dir. Hy. Olympia, light bituminous surfacing, and nonskid seal treatments, 107.1 mi., Primary State Hy. 2, 7 and 10 and Secondary State Hy., 4-c, State Proj., Douglas, Grant and Lincoln Counties.

Bids Asked September 4

New York—A. W. Brandt, supt. P. Wks., State Office Bldg., Albany, imprv. highways, bridges and railroad grade crossing elimination project, Genesee, Washington and Rockland Counties; adv. ENR 8/28.

Bids Asked September 5

Arizona—State Hy. Comn., Phoenix, aggregate base course, special bituminous surface treatment, 6 mi. Ashfork-Flagstaff Hy., SN-FA 89-G (2) (1942), Coconino Co., $69,500. W. R. Hutchins, Phoenix, engr.

+Me., Portland—Public Bldgs. Admin., 9 and D Sts. S.W., Wash., D. C., resurfacing driveways at Post office.

Minnesota—State Hy. Dpt., J. T. Ellison, ch. engr., imprv. 1.8 mi., Trunk Hy. 43-78, SP 2306-07, 2 box culverts; 6.5 mi. TH75-6, AP 4108-03 and TH 75-6, SP 4109-04; 3.5 mi., TH 15-15, SP 4707-02, FAS 147A(1); 7 mi., Deer Creek and Junction Trunk Hy., 10, 213, TH 106-, 184, SP 5622-03; 1.1 mi., TH 27-190, SP 7802-03; 0.3 mi., Albert Lea, TH 65-1, SP 2404-03; 6 mi. east of Ada, 325 cu. yd. excavating, 66 cu. yd. concrete flume, TH 31-31, SP 5401-10; 0.3 mi., TH 169-18, SP 1810-13; 1.087 cu. yd., topsoil, 7,807 cu. yd. sod, near Braham, TH 107-5, SP 3004-14 A; and SP 3004-14 B & C (TH 65-5); 3.4 mi., TH 13-13, SP 4002-14, FAP 294 (4); 2 mi. southwest, 4 mi. north of Ivanhoe, 5 box culverts, TH 75-6, SP 4108-04, TH 75-6, SP 4109-07; 1¼ mi. northwest of Angus, TH 75-6, SP 6011-01; 2.6 mi. State Rd. 11 between Roberds Lake and Faribault, FAS 701 A(2) Proj. 66-503-01, Rice Co.; 7.6 mi., State Rd. 12 between one mile west and 6 miles east [illegible] FAS 110 A (2), Proj. 55-502-62, [illegible] Co.

Missouri—State Hy. Comn., J. [illegible] gravel surfacing 17.8 mi. Jefferson [illegible] Counties; 31.7 mi. Gasconade-Wa[illegible] mi. St. Charles-Warren Counties, [illegible] Perry Counties; 49.9 mi. Franklin [illegible] Cass Co.; 80.6 mi. Marion-Shel[illegible] 62 mi. Monroe-Ralls Counties, [illegible] drian, Monroe, Pike, Ralls and Shel[illegible] 25 mi. Clark, Knox, Lewis, Mari[illegible] and Shelby Counties, 1.327 mi. C[illegible] grading, concrete paving .023 mi. [illegible] grading, graveling 2.273 mi. Ripley [illegible] ing, rolled stone base, bituminou[illegible] 4.113 mi. Harrison Co.; grading, [illegible] 4.729 mi. Clinton Co.; 4.055 mi. [illegible] 2.531 mi. Carroll Co.; 1.373 mi. Clay Co.; grading; crushed stone surfacing 3.832 mi. Roy Co.; 3.027 mi. Ray Co.; grading, aggregate bituminous surfacing 4.016 mi. also 4.4[illegible] mi. both Gasconade Co.; grading, surfacing 0.58[illegible] Barry Co.; grading, concrete surfac[illegible] mi. Christian Co.; grading, crushing aggregate 1.039 mi. Pulaski Co.; grading, [illegible] earth 4.549 mi. Harrison Co.; grading, surfacing 3.433 mi. Adair Co., 1.5 mi. Gundy Co., 2.8[illegible] mi. Sullivan Co.; 2.419 mi. also 2.987 mi. both Scotland Co. C. W. Brown, Jefferson City, state hy. engr.

Pennsylvania—State Hy. Dpt., Harrisburg, bituminous surfacing 18,468 ft. Legislative Route 05075 Bedford Co., 7,398 ft. Legislative Route 57048, Sect. 1, Susquehanna Co.; bituminous and rein.-con. paving 11,138 ft. Legislative Routes, 496 Sect. 8, 86, Sect. 12, Erie Co.; rein.-con. paving, grading, draining 2,[illegible] ft. Legislative Route 25046, West Main St., Corry, Erie Co.; rein.-con. paving, rein.-con. arch and 2 rein.-con. bridges 12,335 ft. Legislative Route 223, Sect. 3, Indiana and Cambria Counties; rein.-con. and brick paving 10,[illegible] ft. Legislatiye Route 82, Sect. 9, 238 Sect. 10, Mercer Co.; rein.-con. paving, 2 plain concrete arches and 1 rein.-con. arch on 18,518 ft. Legislative Route 166, Sect. 11, Northampton Co.; rein.-con. paving, 5 rein.-con. structures 18,246 ft. Legislative Route 21, Charlestown Twp., Tioga Co.; rein.-con. paving, 2 concrete structure, 3 rein.-con. bridges 17,262 ft. Legislative Route 21, Sect. 7, Blossburg Boro, Tioga Co. T. C. Frame, ch. engr.

Bids Asked September 8

Ia., Dakota City—Humboldt Co., c/o Bd. Supervisors, 42,000 cu. yd. gravel surfacing, county roads. $25,000. O. H. Johnson, Dakota City, engr.

Bids Asked September 10

California—State Hy. Dpt., C. H. Purcell, state hy. engr., P. Wks. Bldg., Sacramento, grading, cement treated base and asphaltic con. surfacing, 0.8 mi. and culverts to be extended between Southern Pacific RR and Levee Canal; Kern Co.; 0.2 mi. grading and plantmix surfacing between 6.1 mi. and 5.3 mi. south of Ukiah, Mendocine Co., Ukiah.

+D. C. Wash.—U.S. Eng., 1st and Douglas Sts. N.W., Wash., D. C., excavating, stabilizing and prime coating, placing hot laid asphaltic concrete, etc. at Washington Natl Airport, Gravelly Point; adv. ENR 8/28.

Louisiana—Louisiana Dpt. Hy., Hy. Office Bldg., Baton Rouge, 18 in. bituminous surface treatment, 5.760 mi., Homer-Antioch Hy. Claiborne Parish, Rt. 115, SP 913-03-14.

N. J., Kearny—Town, Town Hall, FA-B-1 surfacing on modified penetration macadam fdn., Hackensack Ave., and 3 St. A. Brokaw, Town Hall, engr.

Bids Asked September 12

★**Pennsylvania**—State Hy. Dpt., T. C. Frame, ch. engr., Harrisburg, paving and bridges on Legislative Rt-73, Sect. 4-A, Legislative R 73, Sect. R5, Traffic R-8, Center, Clay and Brady Twps., Butler Co., over $500,000; paving and bridges Legislative R-8, Sect. 10 and 11, Legislative Route 750 Sect. 4, Traffic Routes 157 and 62, Cranberry, Pine Grove and Washington Twps., Venango and Clarion Counties, over $500,000.

Bids Asked September 16

Iowa, Mt. Pleasant—Henry Co., crushed stone surfacing, $40,000. C. E. Smith, Mt. Pleasant, engr.

Bids Asked September 17

Louisiana—Louisiana Dpt. Hy., Baton Route, concrete paving, 0.568 mi., Cameron-East Hy., Cameron Parish, and blacktopping 0.977 mi., Pine-Thomas Hy., Washington Parish.

Bids Asked

Nev., Reno—Bituminous plant mix, 1,410,000 sq. ft., street and alley, 284,000 sq. ft. alley and street intersections.

New Jersey—E. D. Sterner, Comr., State Hy. Dpt. rejected bids August 22, Kingwood-Bryam Rd., Sect. 5, Hunterdon Co. and Rt. 4 relocation, Sect. 41 A, Monmouth and Middlesex Co., pd adv. CD 8/5—ENR 8/7.

North Carolina—State Hy. & P. Wks. Comn., Raleigh, July 29 bids rejected grading, concrete paving, 1.08 mi., Durham Co. $50,000 to $75,000. W. V. Baise, Raleigh, engr. CD 8/1—ENR 8/7.

Ohio—State Hy. Dpt., Columbus, no bids received, August 12, 3.091 mi. roads, Mahoning Co., 43.51 mi., Erie & Huron Counties, 1.052 mi., Cuyahoga Co.; bids cancelled, 1.677 mi., Lorain Co., 0.006 mi., Hancock Co., CD 7/29—ENR 7/31.

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STREETS, etc. (Bids Asked, Cont'd.)

Utah, Salt Lake City—U. S. Eng., 751 S. Figueroa St., Los Angeles, Calif., cancelled bids to have been opened Aug. 26, street imprv. at Salt Lake Airport. Will readvertise. CD 8/20.

Wisconsin—State Hy. Comn., Madison, August 19 bids rejected, imprv. 5.362 mi., Blair-LaCrosse, Galesville-Blair Rd., Trempealeau Co., and 13.62 mi., Port Wing-Bayfield San River-Bayfield Rd., Bayfield Co. CD 8/22—ENR 8/28.

LOW BIDDERS

Arizona—State Hy. Comn., Phoenix, August 15, imprv. 2.2 mi. Prescott-Flagstaff Hy., Clarkdale, from H. J. Hagen, Globe, $97,899. CD 8/12.

†**Calif., Moffett Field**—Natl. Advisory Comn. for Aeronautics, Ames Laboratory, Moffett Field, Aug. 15, streets and underground utilities in Admin. Area, from M. S. Hanrahan, P. O. Box 429, Redwood City. $114,000. CD 8/6.

Maryland—State Roads Comn., Baltimore, imprv. 0.509 mi. between Middle River Road and Eastern Ave., Baltimore, from Williams Construction Co., Middle River, $374,298. CD 8/11—ENR 8/14.

Minnesota—State Hy. Dpt., St. Paul, August 8, imprv. 11.2 mi. between Waterville and Junction TH 99, from DeRuyter Bros., Willmar, $168,652***12 mi. between East and West Carver County Line, from J. Meland, Hawley, $47,235***1.1 mi. Squaw Lake from W. Collins & Sons, Moorhead. $33,660. CD 7/22—ENR 7/24.

Nebraska—Dpt. Rd. and Irrigation, Lincoln, August 14 grading, paving, culverts, Millard-Omaha, from Yant Constr. Co., 915-45 St., Omaha. $34,892. CD 8/1—ENR 8/7.

N. J., Trenton—City Comn., asphalt paving Cummings Ave. from Union Paving Co., Broad and Stiles Co., Phila, Pa., $26,186.

★**N. Y., Kew Gardens** — President Queens Boro, Queens Boro Hall, 120-55 Queens Blvd., Aug. 20, grading, regrading, etc., 69 St., from Garofano Constr. Co., 730 Columbus Ave., Mt. Vernon. **$1,352,185.** CD 8/12—ENR 8/14.

N. Y., St. George—Dpt. Mental Hygiene, State Office Bldg., Albany, Aug. 20, roads, walks at New York State School for Mental Defectives, Willowbrook, near here, from Vanbro Constr. Corp., West Brighton, Staten Island, $297,000. CD 8/5—ENR 8/7.

North Carolina—State Hy. & P. Wks., Comn., Raleigh, August 20, imprv. 7.02 mi., U. S. rt. 1, Warren Co. from Cobb & Homewood, Chapel Hill, $42,452;***10.61 mi., between Williamston & Beaufort Co. Line, Martin Co. from F. D. Cline, Raleigh, $46,305.

†**Washington**—Public Roads Admin., Post Office Bldg., Portland, Ore., Aug. 20, bituminous surfacing 8.5 mi. Mount Adams Hy., Columbia Natl. Forest, Klickitat Co., from Babler Bros., 1636 S.E. 6 St., Portland, Ore., $52,338. CD 8/11.

Wisconsin — State Hy. Comn., Madison, August 19, imprv. 5.362 mi. Blair-LaCrosse Rd., Galesville-Blair Rd., Trempealeau Co., from L. G. Arnold, Inc., Eau Claire, **$163,869** *** 3.219 mi. Durand-Ellsworth Rd., West County Line-Arkansaw Rd., Pepin Co., from W. Lathers, Jr., Madison, **$190,498***5.890 mi. Antigo-Eagle River Rd., Hiles Jct.-Three Lakes Rd., Oneida Co., from J. O'Keefe, DePere, **$159,525***13.62 mi. Port Wing-Bayfield Rd., Sand River-Bayfield Rd., Bayfield Co., from O. Wiesner, Superior, **$57,055***0.757 mi. Hukella and Smith Creek Structures, Parkland-East County Line Iron River Rd., Douglas Co., from Highway Supply Co., Webster, **$32,540***imprv. 0.773 mi. Madison-Dodgeville Rd., Mt. Horeb-Blue Mounds-Barndveld Rd., Iowa and Dane Counties, from Lampert & Lampert, Oshkosh, **$38,608***1.891 mi. Devils Lake State Park-Baraboo Rd., State Park-Baraboo Rd., Sauk Co., no bids received. CD 7/30—ENR 8/7.

CONTRACTS AWARDED

†**California**—War Dpt., 20 St. and Constitution Ave. N.W., Wash., D. C., surfaced and paved roads, Fort Rosecran, San Diego, and Camp Callan, La Jolla, to Daly Corp., 4430 Boundary St., San Diego. **$373,038.**

Calif., San Francisco—J. Hester, scy. Dpt. P. Wks., City Hall, imprv. Lombard St., to C. L. Harney, Call Bldg., **$338,071.** Bids 8/13. CD 8/23.

Calif., San Mateo—City Council, imprv. Subdivision 2, Hillsdale and El Camino Real to Piazza and Huntley, 195 N. 6 St., San Jose, **$26,461.** Bids Aug. 18. CD 8/11.

Colo., Denver—Imprv. West 3 St. etc. WPA. **$62,888.**

★**Florida**—State Rd. Dpt., Tallahassee, T. A. Johnson, chn., impr. 8¼ mi., Rd. 21 near Daytona Beach in Volusia Co., to M. J. Carroll, Leesburg, **$724,000.** CD 7/14 ENR 7/17.

†**Idaho**—Pub. Roads Admin., Ogden, bituminous topping, 10.4 mi. Stierman-Idaho City section Boise-Idaho City Hy., to Triangle Constr. Co., 1707 Crescent Rim Dr., Boise. **$121,485.**

Ill., Cicero — Bituminous surfacing city streets to Leininger Constr. Co., 30 N. LaSalle St., Chicago. **$45,622.**

Ill., Dixon—Lee Co., concrete paving, co. rds., to F. F. Weir Constr. Co., Moline. **$30,622.**

Ill., Elmhurst—Bituminous concrete surfacing, city streets, to Black Top Roads, 1929 Narragansett Ave., Chicago. **$29,363.**

Ia., Cedar Rapids—Linn Co., grading on six five projects, to G. H. Lowe, Cedar Rapids. **$35,851.** W. Behrens, Co. engr.

Ia., Fort Madison—L. F. Alb[illegible] city cs paving, curbing, guttering, Hargrave Constr. Co., Cedar Rapids. $1[illegible],000. R. Lewis, city engr. CD 7/29.

Iowa, Keokuk—Lee Co., imprv. gravel roads, to Myron Baker, Independence. $25,000.

†**Mass., Falmouth**—Con. Q.M. bituminous macadam surface for truck [illegible] area, Camp Edwards to M. F. Roach & Son, Inc., Spring St., East Bridgewater, $71,000.

Mass., Medford — Commonwealth Mass Metropolitan Dist., Park Div., 20 [illegible] interest to Boston, bituminous macadam traffic [illegible] and approaches, intersection Middlesex Fells Parkway, Mystic Valley Parkway, and Revere Beach Parkway, to C. and R. Constr. Co., Harrison Ave., Roslindale (Boston), Ea[illegible] **$81,050.** Bids 8/14. CD 7/31—ENR 8/7.

†**Mich., Fort Custer**—Con. Q.M., 10 mi. [illegible] sidewalks, to West Shore Constr. Co., Zeeland. **$38,969.**

Mich., Grand Rapids—Kent Co., paving 1 mi. Walker Rd. from County Rd. 500 north to Tyrone Twp., to P. C. Miller, Sparta. **$63,700.**

Minnesota—State Hy. Dpt., St. Paul, impr. 6.6 mi. between Glenwood and North Pope County Line to Megarry Bros., St. Cloud, **$63,869;** imprv. 2.7 mi., between Rice St. and Junction TH 61, to Okes Constr. Co., [illegible] First Natl. Bank Bldg., St. Paul, $65,389. CD 7/22—ENR 7/24.

★**Missouri**—State Hy. Comn., Jefferson City, imprv. 4.162 mi. also 4.283 mi. Mi. road both Ray Co., to Cameron, Joyce & Co., Keokuk, Ia. and Illinois Valley Constr. Co., Chicago, Ill., **$159,600** and **$189,642** respectively***2.6 mi. Wayne Co., to Koss Constr. Co., 2[illegible] Colony Bldg., Des Moines, Ia., $58,513***4.[illegible] mi. also 1.802 mi. road, both Randolph Co., to Cameron Joyce & Co., Keokuk, Ia., $221,895 and **$94,647** respectively. Grand total **$724,297.** Rejected imprv. bids 3.841 St. Charles Co., 0.023 mi. Scott Co., 64.5 mi. Iron, Perry Counties; 69.9 mi. Franklin Co., 14 mi. St. Charles and Warren counties. CD 7/[illegible] —ENR 7/31 under LB.

Nev., Reno—Conc. curbs, walks, pavements various alleys, to L. Christensen, Reno, $67,980.

New Mexico—B. G. Dwyre, engr., state hy. Dpt., Santa Fe, imprv. 5.709 mi. McKinley Co., to Hayner & Burn, Las Cruses and Capitol Constr. Co., Santa Fe, $104,806*** drainage structures Catron Co., to Hoss Bros., Albuquerque, **$52,632***imprv. 32.7 mi. Hidalgo Co., to Skousen Bros., Albuquerque, **$29,999***1.69 mi. San Miguel Co., to W. T. Bookout, Las Vegas, **$104,045.** Grand total **$291,483.** Rejected bids received Aug. 11, 0.185 mi. Colfax Co., 12.131 mi. Grant Co. CD 8/5—ENR 8/7.

N. J., Bayonne — Removing trolley tracks excavating, grading, repairing with granite blocks, Ave. C from 1 St. to Morris Canal. **WPA. $78,442.** H. A. Jaeger, City Hall. Owners and WPA, engr.

N. J., Montclair—Grading, 3 in. penetration macadam surfacing, various streets. WPA **$65,000.**, J. B. Hyden, Town Hall, Town and WPA engr. CD 7/25—ENR 7/31.

N. J., Mt. Holly—Burlington Co., Court House, excavating, grading, gravel surface access roads, to Fort Dix, **WPA. $54,500.** D. Cougle, 1102 S. Broad St., Trenton, WPA and Owners, engr.

N. J., Newark—St. Dpt., City Hall, excavating, grading, 6 in. concrete base on [illegible] asphaltic surfacing, various streets. WPA **$73,500.** G Andress, City Hall, City and WPA engr.

N. Y., Brooklyn—President Brooklyn Boro Boro Hall, repaving, concrete fdn. on Warwick St., etc. WPA, **$103,779.** W. W. Johnstone, 70 Columbus Ave., New York, dir. Div. Operations.

†**N. Y., Fort Totten**—Con. Q.M., new roads and imprv. existing roads, to South Shore Contg. & Dredging Corp., Patchogue. $65,188.

N. Y., Little Valley—Chattaraugus Co. Court House, imprv. highway sys., own forces. **$79,000.**

N. Y., New York—President Manhattan Boro, Municipal Bldg., repaving, recurbing, widening sidewalk, etc. north of 59 St., WPA **$427,977.** W. W. Johnstone, 70 Columbus Ave., dir. Div. Operations.

O., Lancaster—Bd. Comrs., Fairfield co., imprv. 44.34 mi., various co. rds. to T. D. Van Camp & Sons, 55 E. State St., Columbus. **$25,764.** Bids 7/29. CD 7/24.

O., Lorain—City, grading, draining and paving streets, in Collar Day allotment to Peirce Constr. Co., 2140 Ashland Ave., Toledo, $29,428.

Oregon—State Hy. Comn., Portland, imprv. 3.2 mi. Linn Co., to Warren-North West, Inc., 102 and Warren Rd., Portland, $78,707*** 5.06 mi. Wasco Co. and 2.99 mi. Columbia Co., to Porter W. Yett, 6500 N.E. Ainsworth St., Portland, **$112,498** and **$108,120** respectively. Grand total **$299,325.** Bids 8/14. Rejected bids 8.14 imprv. 1.26 mi. Lane Co. and 3.5 mi. Lincoln Co. CD 8/5—ENR 8/7.

Pa., Dupont—Boro Council, A. M. Zaranick secy., bituminous stone surfacing Wyoming and Center Sts., own forces. $25,000. J. J. Reilly, 500 Newrose Bldg., Pittston, engr.

Pa., Pittsburgh—Allegheny Co., concrete and asphalt paving Park Ave., Braddock Twp. to McCrady Constr. Co., 239 4 Ave., $39,121; grading, paving, draining at maintenance

STREETS, etc. (Contracts Awarded, Cont'd.)

warehouse, O'Hara Twp., to M. F. Gerhold, Palm Garden Village, Pittsburgh, **$39,194.**

Tex., Fort Worth—S. H. Bothwell, city mgr., repaving Bailey Ave. from W. 7 to White Settlement Rd. 54, **WPA. $98,966.**

Utah—State Rd. Comn., Salt Lake City, imprv. 6.791 mi., State Rd. between Cover Fort and Dog Valley, to J. W. Mendenhall & Sons Co., Springville, **$173,345.** Bids 8/15—CD 8/1.

Utah—State Road Comn., State Capitol Bldg., Salt Lake City, imprv. 6.16 mi., State Hy. between Garland and Plymouth, to Olaf Nelson, Logan. **$189,229.** CD 8/5.

Vermont—State Hy. Dpt., H. E. Sargent, ch. engr., Montpelier, imprv. 7.757 mi. road, St. Johnsbury, and Waterford, to Velleher Corp., 35 Walnut St., Turners Falls. **$70,995.** Bids August 8. CD 7/28—ENR 7/21.

Wyoming—Wyoming Hy. Comn., F. Kelso, supt., Cheyenne, imprv. 12.178 mi. Hanna-Rock River River Rd., Carbon Co. to Blanchard Brothers, Campstool Route. **$208,533;** imprv. 15.635 mi., Cheyann-Pine Bluffs Road, Laramie Co. to Big Horn Construction Co., Sheridan. **$105,999.** Bids rejected August 18, imprv. 2.564 mi. 2 R. C. Culverts, etc. Urie-Carter Road, Uinta Co. Will readvertise. CD 8/8.

N. B., Campbellton—Paving 8 streets, to Warren Bituminous Paving Co. Ltd., 437 Fleet St., Toronto, Ont. **$35,000.** J. T. Reid, Campbellton, clk.

Ont., Port Arthur—W. V. McConber, clk., paving streets, to Tomlinson Constr. Co., Ltd., 1 Somerset Bldg., Winnipeg, Man. Est. **$25,000.**

★**Quebec**—Dpt. Roads, Quebec City, 60 mi. road along Peribonka River, to Dufresne Constr. Co., Ltd., 1823 Pie IX Blvd., Montreal. Est. **$1,000,000.**

Quebec—Provincial Government. Quebec City, grading, graveling 6 mi. Ste. Anne de Beaupre, to U. Ste. Marie, 61 St. Cleopha St., Beauport, **$100,000;** 3½ mi. concrete paving, St. Dunstan, to Union Paving & Quarry Co., Ltd., 48 Second St., Quebec City, **$31,500.** E. Gohier, Dpt. Roads, Quebec City, engr.

Quebec — Provincial Government, Quebec City, bituminous concrete paving 13 mi. Quebec City, to Massicotta & Son, Notre Dame St., Cap de la Madeleine, **$85,700;** grading, graveling 3 mi. Neubille, to C. Gagnon, 220 Grande Allee, Quebec City. Est. **$25,000.**

Quebec—Deputy Minister Dpt. Roads, Quebec City, imprv. 8 mi. Hy. 18, St. Henri de Mascanche and St. Esprit road, and 11.8 mi. Rouyn-Arntfield Rd., to H. J. O'Connell, Ltd., Canada Cement Bldg., Montreal. **$55,000** and **$80,500** respectively. Bids 7/16 and 7/22 respectively. CD 7/10 and 7/16.

EARTHWORK, WATERWAYS

PROPOSED WORK

†**California**—U. S. Bureau Reclamation, Old Postoffice Bldg., Sacramento, 165 mi. Friant-Kern Canal of Friant Div., Central Valley Project.

Calif., Seal Beach—Voted $198,700 bonds constructing jetty, groins and dredging. CD 4/30—ENR 5/8.

Idaho, Preston — Preston-Whitney Irr. Co., Angus Condie, sec., plans irrigation storage reservoir. $73,000.

Kansas—U. S. Eng., 601 Davidson Bldg., Kansas City, Mo., 2,500 ft. pile revetment with suspended mattress in Missouri River between Doniphan and Rushville Bends, 6 mi. from Atchison. $35,000.

†**Missouri**—U. S. Eng., 1709 Jackson St., Omaha, Neb., 8,970 ft. revetment in Missouri River between Peru and Rulo Bends, center of work near Nishnabotna. $200,000.

†**Nebraska**—U. S. Eng., 1709 Jackson St., Omaha, 8,000 ft. revetment in Missouri River between Sioux City and Winnebago Bends, about 7 mi. downstream from Homer. $175,000.

N. J., Dover—Morris Co., Court House, Morristown, excavating, drainage ditches, Picatinny Arsenal. $66,877. C. Malstrom, Orange and N. 6 St., Newark, WPA and owner's engr.

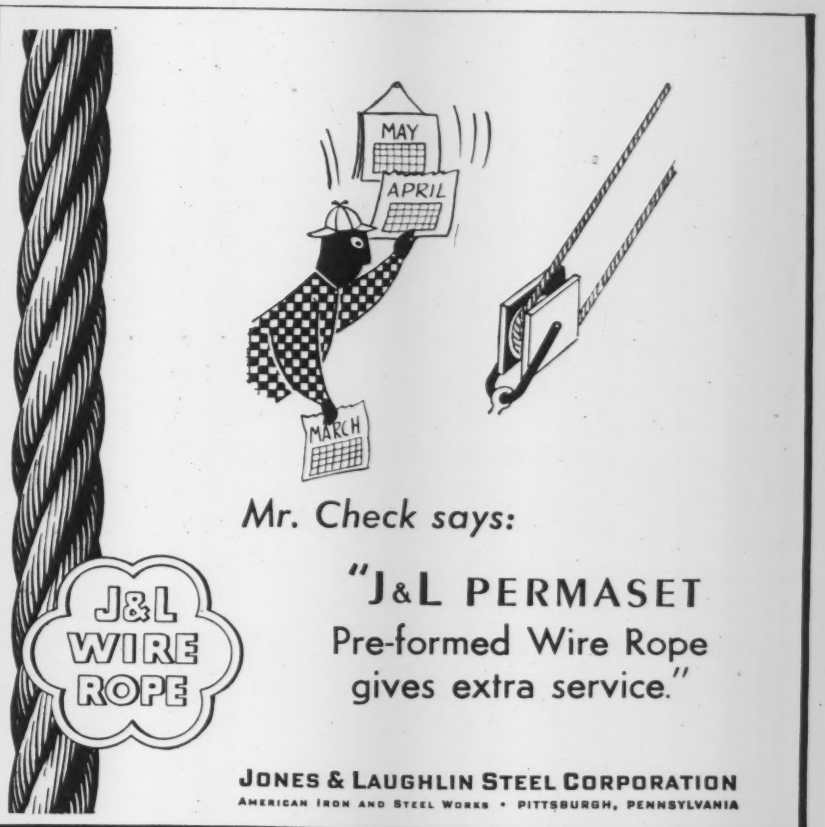
N. C., Charlotte—Mecklenburg Co., Drainage Comn., Dr. J. R. Alexander, chn., drainage, removing obstructions Little Sugaw Creek from Elizabeth Ave. to point near Park Rd., over $100,000, Coffey Creek, near Air Base, $20,000, both Mecklenburg Co.

★**Tex., Canyon** — Guadluoe-Blanco River Auth., c/o I. A. Ogden, New Braunfels, 2 dams and other power producing facilities. $12,000,000. Fargo Eng. Co., Jackson, Mich., consult. engrs.

Tex., Edinburg—Hidalgo Co. Drainage Dists. 1 and 2, c/o B. F. McKee, aud., $250,000 bond election, drainage sys., etc. H. P. Griffin, co. engr.

†**Tex., Port Lavaca**—U. S. Eng., 1 and Douglas Sts., N.W., Wash., D. C., channel clearing, straightening and enlargement Lavaca and Navidad Rivers. $150,000.

★**Tex., San Antonio**—A. Marbach, engr., City Hall, grading, rock walling, concrete lining and draining Creek Channels. $926,000.



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EARTHWORK, etc. (Proposed Work, Cont'd.)

†**Washington**—Bureau Reclamation, Yakima, bids probably next year, Wasteway No. 5, Rosa Div., Yakima Project.

Wash., Dayton—U. S. Eng., Pittock Blk., Portland, Ore., flood control work on Touchet River. $146,000.

BIDS ASKED

Bids Asked September 2

La., Avondale—Public Belt Railroad Comn., Municipal Bldg. embankment approx. 2,200 cu. yd. river sand, other satisfactory material, and excavation, disposal, unsuitable material.

Bids Asked September 4

†**Nebraska**—U. S. Eng., Davidson Bldg., Kansas City, Mo., stand dikes and revetment from Rulo to Quindaro Bends. CD 8/12—ENR 8/14 under Missouri.

†**S. D., Fargo**—U. S. Eng., P. O. & Customhouse, St. Paul, Minn., 3,950 ft. steel dike and 4,739 ft. revetment adjacent Missouri River.

Bids Asked September 8

California—Bureau Reclamation, Old Post Office Bldg., Sacramento, earthworth, structures, Battle Creek Road, migratory-fish control, Kennett Div., Central Valley Project, near Redding, Spec. 970.

†**Delaware**—U. S. Eng., 900 Customhouse, 2 and Chestnut Sts., Phila., Pa., placing 27,000 tons rubble stone to from exten. to northern one of 2 existing stone jetties, Delaware River at entrance Chesapeake and Delaware Canal. Reedy Point.

Bids Asked September 9

★**Missouri**—U. S. Eng., 601 Davidson Bldg., Kansas City, Mo,. 5, 590 ft. dikes, 5, 250 ft. revetment and excavating 430,000 yd. earth for pilot canal between Malta and Rocheport Bends in Missouri River. $250,000. CD 8/18—ENR 8/21.

New York—Pub. Wks. Officer, 3rd Naval Dist., 90 Church St., New York, 105,000 cu. yd. dredging along north and south sides of Pier 7, at Tompkinsville.

Bids Asked September 12

†**Washington**—Bureua Reclamation, Denver, Colo., fabricated structural steel for Grand Coulee power plant, Columbia Basin Project. Spec. 1557-D.

Bids Asked September 19

†**Michigan**—U. S. Eng., 613 Federal Bldg., Detroit, removing and disposing 3, 500 lin. ft. plank revetment, also 1, 125,000 cu. yd. place measure, of material other than ledge rock from Saginaw River between Saginaw and Bay City; adv. ENR 8/28.

LOW BIDDERS

★†**Florida**—U. S. Eng., P. O. Box 4970 Jacksonville, Aug. 19, St. Lucie Dam on St. Lucie Canal about 8 mi. inland from Stuart, 7 steel taintor gates, operating machinery, etc., from V. P. Loftis, Builders Bldg., Charlotte, N. C. $571,134. CD 7/22—ENR 7/24.

†**Illinois**—U. S. Eng., 932 Post Office Bldg., Chicago, reconstructing upper approach wall, Dresden Island Lock, Illinois Waterway, from Great Lakes Dredge & Dock Co., 122 S. Michigan Ave., Chicago, $109,070. Bids 8/11. CD 8/5.

†**Minnesota**—U. S. Eng., St. Paul, Aug. 4. channel imprvs. Minnesota River between Watson, Montevideo and Granite Falls, from W. W. Magee Co., 180 N. Snelling Ave., St. Paul. $139,920. CD 7/15—ENR 7/17.

Ore., Tillamook City—Trask Drainage Dist., Aug. 15, dike constr., from S. S. Montague, 115 SW. Fourth, Portland. $20,069.

†**Texas**—U. S. Eng., Federal Bldg., Galveston, Aug. 18, dredging 1,528,000 cu. yd. from Louisiana-Texas Intercoastal waterway, from Bauer Smith Dredging Co., Inc., Port Lavaca, $152,800. CD 8/11.

†**Texas**—U. S. Eng., Federal Bldg., Galveston, Aug. 18, 1,296,000 cu. yd. material from Louisiana-Texas Intracoastal waterway between Colorado River at Matagorda, Tex. and deep water in Matagorda Bay near Palacios, from Jahncke Service, Inc., 814 Howard Ave., New Orleans, La. $145,282. CD 8/11.

Wash., Port Angeles—U. S. Eng., Central Bldg., Seattle, 8,200 ft. rubble stone breakwater at Neah Bay, near here, from Columbia Constr. Co., Westport. **$3,635,250.** CD 7/25—ENR 7/31.

CONTRACTS AWARDED

Ill., Rock Island—State, Springfield, 600 ft. seawall on S. bank Mississippi River, between 17 and 19 Sts., to McCarthy Imprv. Co., Davenport. **$139,518.** CD 5/8—ENR 5/16.

★†**Indiana**—U. S. Eng., P. O. Box 59, Louisville, Ky., flood protection works East Sect. Unit 1, Jeffersonville, Clark Co., to Robert R. Anderson Co., 625 N. Kedzie Ave., Chicago, Ill. **$1,202,595.** CD 7/30—ENR 8/7.

La., New Orleans—Bd. Comrs., Caddo Levee Dist., 326 steel-frame fascine boxes, approx. 6,500 linear ft., steel frame facine spacer boxes for bank protection, Red River, at Herndon Pl., Caddo Parrish to Salley & Ellis, Monroe, **$102,173.** Awarded 8/15.

N. J., Atlantic City—Atlantic Co., Courthouse, grading banks, stream clearance, various streams. WPA. **$40,000.** G. R. Swinton, 930 Atlantic Ave., Atlantic City, WPA and owners, engr. CD 7/25—ENR 7/31.

N. J., Clifton — Excav., grading, Weasel Brook. **WPA. $31,374.** C. Mattson, Orange and N. 6 St., Newark, owner and WPA engr.

N. J., East Orange—Excavating, grading, rein.-con. floor in 2 River for flood control. **WPA. $31,154.** CD 7/25—ENR 7/31.

†**N. J., Fort Monmouth**—Con. Q.M. excavating, draining, post expansion area and landscaping. WPA. **$65,000.**

Pa., Lock Haven—W. Ohls, city engr., repairing, imprv. Lock Haven Dam over West Branch Susquehanna River, own forces. **$17,520.**

★**Texas, Edentown**—Santa Cruz Farm, Inc., c/o Benson Bros., Mission, construct and lining canals, laying pipe, installing irrigation controls, gates, etc. on 9,800 acre tract, day labor and sub-contract method. $500,000.

†**Wash., Enumclaw** — U. S. Eng., Central Bldg., Seattle, excavating below original river bed level at Mud Mountain Dam, near here, to Guy F. Atkinson Co., Russ Bldg., San Francisco, Calif. **$25,251.**

★**N. B., St. John**—Dpt. P. Wks., Ottawa, Ont., dredging Courtney Bay, to Canadian Dredge & Dock Co., Ltd., Harbour Comm. Bldg., Toronto, Ont. **$553,122.**

N. S., Dingwall — Dpt. P. Wks., Ottawa, Ont., dredging, to C. S. Boone Dredging & Constr. Co., Ltd., 80 Richmond St. W., Toronto, Ont. **$77,848.** CD 6/19—ENR 7/3.

Ont., Sault Ste. Marie—Canada Steamships Ltd., 715 Victoria Sq., Montreal, Que., retaining wall along dock, etc., to Richardson Constr. Co., Ltd., 10 E. Adelaide St., Toronto Est. **$40,000.** B. R. Perry, 620 Cathcart St., Montreal, Que., archt.

UNCLASSIFIED

PROPOSED WORK

Arkansas — TRANSMISSION LINES — Ashley-Chicot-Union Elec. Co-op., Hamburg, bids soon 171 mi. transmission lines, $172,000 REA. N. B. Gieb & Assoc., Monroe, La., engr.

Ark., Hamburg—RURAL ELECTRIC LINES—Ashley Union Chicot Elec. Co-op., REA lines, $175,000. H. B. Gieb, Berniiart Bldg., Monroe La., engr.

Ark., Humphrey — RURAL ELECTRIC LINES—Riceland Elec. Co-op., 230 mi. REA lines. $230,000.

Calif., Hemet—AIRPORT BLDG. EXTENSION—Ryan School of Aeronautics, expansion bldgs., training center, $50,000.

Calif., Los Banos—SWIMMING POOL—municipal swimming pool. Est. $25,000.

Calif., Marysville—AIRPORT—U. S. Eng., 208 Postoffice Bldg., Sacramento, landing strip, runways, taxiways, appurtenant facilities, Municipal Airport.

★**Colorado**—RURAL TRANSMISSION LINES—High Line Elec. Assoc., Holyoke, 324 mi. transmission lines, $777,000 REA. Rocky Mountain Engr. Co., Denver, engr. CD 8/8—ENR 8/21.

★†**Del., New Castle**—RUNWAYS—U. S. Eng., Phila., Pa., three 150x5000 ft. runways $500,000.

Idaho, Coeur d'Alene—AIRPORT—U. S. Engineers, Pittock Block, Portland, Ore., bids soon, 2 landing strips, paving 150x5,400 ft. runways, apron, basic lighting, at airport. $401,000. CAA.

Iowa—RURAL ELECTRIC TRANSMISSION LINES—Mitchell Co. REA Co-operative, St. Ansgar, bids soon, 147 mi. rural electric transmission lines, Mitchell, Floyd, Chickasaw, and Worth Counties. $128,000. Stanley Engineering Co., Muscatine, engr. CD 8/4.

Ia., Iowa City—POOL—$62,500 bond election, September 4, swimming pool.

Ia., Pocahontas—TRANSMISSION LINES—Pocahontas County REA Co-op., 85 mi. addnl. rural electric transmisison lines, serve 700 members, $73,000. Tinsley, McBroom & Higgins, 602 Hubbell Bldg., Des Moines, engr.

Ia., Washington — POOL — City, swimming pool. $28,000.

Ia., Waterloo—TRACKS, etc.—Illinois Central R.R., C. H. Mottler, ch. engr., 135 E. 11 Pl., Chicago, Ill., track facilities, roundhouse, terminal. $110,000.

Ia., Waterloo—TRACKS, etc.—Waterloo, Cedar Falls & Northern R.R., T. E. Rust, ch. engr., Waterloo, railroad facilities incl. track extens. $33,389.

Kansas — RURAL ELECTRIC LINES—Nemaha-Marshall Electric Cooperative Assoc., Inc., Axtell, 229 mi. rural lines. $163,000 REA. Paulette & Wilson, Topeka, engrs. CD 8/8—ENR 8/21.

La., Mandeville — PIPELINE — United Gas Pipe Line Co., Standard Petr. Bldg., Houston, Texas, 200 mi. natural gas steel pipe lines 14 to 16 in. pipe. $450,000.

Mass., Haverhill—SWIMMING POOL—P. Wks. Dpt., concrete swimming pool, $25,000.

Miss., Waveland — GAS SYSTEM — Voted bonds approved natural gas sys. $80,000. F. P. Joseph, Glenmora, La., engr.

Minn., Bemidji—RURAL DISTRIBUTION SYSTEM—Beltrami Elec. Cooperative, Inc., C. Moller, coordinator, 329 mi., rural elec. distr.

UNCLASSIFIED (Proposed Work, Cont'd.)

sys., Beltrami Co. $249,000. REA. General Engineering Corp., 2944 Cedar Ave., Minneapolis, engr.

Minn., Bigfork—RURAL DISTRIBUTION LINES—North Itasca Elec. Cooperative, Inc., M. Nessoth, pres., 285 mi. rural elec. distr. sys., Itasca and Koochiching Counties, $220,000. REA. General Engineering Corp., 2944 Cedar Ave., Minneapolis, engr.

Minn., Roseau—RURAL DISTRIBUTION SYSTEM—Roseau Elec. Cooperative, Inc., H. W. Jensen, pres., bids soon, 254 mi., rural elec. distr. sys. Roseau Co., $218,000. General Engineering Corp., 2944 Cedar Ave., Minneapolis, engr.

Missouri — RURAL ELECTRIC LINES — Farmers Electric Co-operative, E. Wood, supt., Chillicothe, bids soon 75 mi. transmission lines, De Kalb, Clinton, Carroll, Charlton, Daviess, Livingston and Ray Counties. $67,000 REA allot. F. Horton & Co., Lamar, engr. CD 8/7—ENR 8/14.

★**†Mo., Vichy**—AIRPORT—War Dpt., 20 St. and Constitution Ave., N.W., Wash., D. C., airport, incl. four 5,500 ft. rein.-con. runways, concrete aprons and ramp, hangars, shops, barracks, water, sewer and lighting facilities, etc. $1,500,000.

Mont., Billings—LANDING STRIPS, etc.—U. S. Eng., Fort Peck, bids soon extend, landing strips, constructing 150x5600 ft. runway with taxiways, etc., at airport, for City, CAA. $137,000.

Mont., Great Falls—LANDING STRIP, etc.—U. S. Eng., Fort Peck, bids soon exten. landing strip, paving 150x700 ft. runway exten., etc., for City. CAA. $36,000.

†Pa., Middletown—U. S. Eng., Wash., D. C., expanding heating facilities at Olmstead Field. $485,000.

Neb., Lincoln—AIRPORT—Imprv. municipal airport. $434,000. WPA.

N. J., Bayonne—RECREATION AREA—Excavating, grading, landscaping, etc. for recreation area, $71,500. C. Malstrom, Orange and N. 6 St., Newark, WPA and owner's engr.

N. J., Bayonne—PARK—Imprv. recreation area, 16 St., $58,000. H. A. Jaeger, City Hall, city and WPA engr.

N. J., Camden—PARK IMPROVEMENTS—Camden Co., Park Com., Court House, excavating, grading, landscaping, etc., various parks, $73,500. G. R. Swinton, 930 Atlantic Ave., Atlantic City, WPA and owners, engr.

N. J., Newark—AIRPORT IMPROVEMENTS—City Hall, excavating, electrical conduits, manholes, lights, etc., Newark Airport, $91,349. A. Armstrong, Admin. Bldg., Newark Airport, owner, WPA, engr.

N. J., South Orange — IMPROVING GROUNDS—City Newark, City Hall, imprv. excavating, grading, landscaping, tennis courts, Ivy Hill Alms House. $55,000. C. Malstrom, Orange and N. 6 St., Newark, WPA and Owners engr.

★**†N. Y., Manitou Beach**—SHIPYARD—Odenback Shipbuilding Corp., Manitou Beach, plans shipyard, $720,000 for land and buildings, $150,000 machinery and equip., for Maritime Comn. Defense Plant Corp. will finance.

★**N. Y., Russell**—MINE DEVELOPMENT—Clifton Ore Co., Inc., (subsidiary M. A. Hanna Co.) from Iron River, Mich., developing mine. $1,500,000. R. S Walker, c/o M. A. Hanna Corp., Leader Bldg., Cleveland, O., engr.

Oregon—RURAL ELECTRIC LINES—Lane Co., Electric Co-operative, Eugene, bids soon, 334 mi. rural electric distr. lines. $300,000. J. W. Cunningham, Spalding Bldg., Portland, engr.

†Ore., Astoria — NAVAL AIR STATION — Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., additional buildings and facilities at Tongue Point Naval Air Station. $450,000.

Ore., Klamath Falls—AIRPORT—U. S. Engineers, Pittock Blk., Portland, bids 90 days, 150x5,100 ft. runway, 500 ft. runway extens., taxiways, grading, draining, paving, for city, $278,000. CAA.

Ore., Tillamook—AIRPORT—U. S. Engineers, Pittock Block, Portland, bids 90 days, 2 landing strips, paving 150x4,000 ft. runways, 50x3,460 ft. taxiways, 200x300 ft. parking apron for city. $410,000.

Pa., Midland—PETROLEUM TERMINAL—Socony Vacuum Oil Co., 230 Park Ave., New York City, marine petroleum products terminal.

S. C., Chester—AIRPORT—City and Chester Co., airport, 4 mi. from here. $350,000. R. Frazer, mayor.

Tenn., Lafayette—TRANSMISSION LINES—Tri County Elec. Corp., transmission lines, REA. $80,000. P. M. Sullivan, Roxy Theatre Bldg., Galatin, engr.

Texas — TRANSMISSION LINES — Medina Electric Co-operative, Inc., Hondo, bids soon, 158 mi. electric power transmission lines, Medina, Frio and LaSalle Counties. $85,000. J. W. Beretta Engineers, Inc., c/o Natl. Bank Bldg., San Antonio, engrs. CD 3/6—ENR 3/13.

Texas — RURAL ELECTRIC LINES — Rusk County Electric Co-operative, Inc., W. F. Mehner, pres., Henderson, bids soon, 226 mi. rural electric power transmission lines, Rusk Co. $125,000 REA allot. Freese & Nichols, Capps Bldg., Fort Worth, engrs. CD 8/7—ENR 8/14.

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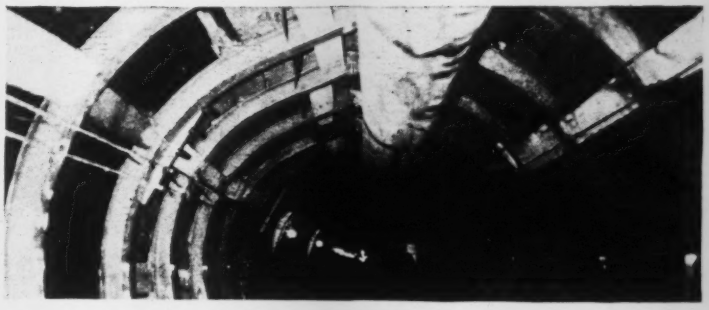

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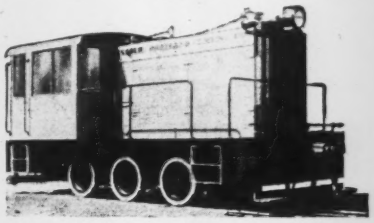

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UNCLASSIFIED (Proposed Work, Cont'd.)

Tex., Arlington — AIRPORT IMPROVEMENTS—Town, airport imprvs., hangars, administration building, shops, etc. $100,000.

Tex., Ballinger—LANDING FIELD, etc.—F. Harman, c/o Harman Flying School, San Marcos additional landing field imprvs. and hangar. $54,067.

Tex., Brownsville—AIRPORT IMPROVEMENTS — City, airport improvements, hangars, administration building, fueling sys., etc. $90,000. W. O. Washington, Brownsville, engr.

Tex., Corpus Christi—AIRPORT IMPROVEMENTS—City, hangars, administration building, shop, fueling sys., etc. $110,000. N. Hardy, Nixon Bldg., archt.

Tex., Fort Worth—HANGAR—S. H. Bothwell, city mgr., rejected bids July 19, addn. to north hangar, shops, office. $60,000. CD 7/29—ENR 7/31 under LB.

Tex., Galveston—FENCE—13 ft. chain link, non-climable fence around dry docks and Naval Section Base project. $96,569. C. C. Washington, 1615 18 St., consult. engr.

Tex., Georgetown—AIRPORT IMPROVEMENTS—City, airport imprvs., hangars, administration building, shop, fueling sys. Est. $100,000.

†Tex., Grand Prairie—AVIATION BASE—U.S. Eng., 1 and Douglas Sts. N.W., Wash., D. C., reserve aviation base facilities, barracks, utilities, etc. $145,000.

Tex., Greenville—AIRPORT IMPROVEMENTS—City, airport imprvs., hangars, administration building, shop, storage building, etc. $150,000.

Tex., Hillsboro—FAIR GROUND DEVELOPMENT, etc.—City, fair, park and market purposes, incl. concrete swimming pool, grading, draining, leveling grounds, etc., 44 acre site. $100,000.

Tex., Houston — SUBMARINE CHASER PLANT—Platzer Shipbuilding & Dry Dock Co., R. M. Farrar, pres., Union Natl. Bank, submarine chaser facilities, 8 mi. south on channel at Irish Bend. $150,000.

Tex., Kerrville—AIRPORT—City, airport buildings. $75,000.

Tex., Orange—SWIMMING POOL, etc.—Swimming pool, athletic courts, small club bldg., drainage, grading, leveling grounds, etc. $130,000.

†Tex., San Antonio—U. S. Eng., Federal Bldg., Galveston, bids soon, two 4,500x150 ft., rein.-con. runways, grading, draining, leveling, lighting, etc., Kelly Field. Received no bids 6/30. CD 6/17—ENR 6/19.

Tex., Temple — AIRPORT — City, airport buildings. $120,000.

Tex., Vernon — AIRPORT — City, hangars, shop, administration building, etc. $70,000.

Tex., Vernon—AIRPORT—U. S. Eng., Federal Bldg., Galveston, airport. $295,000. CAA.

★**†Tex., Waco**—FLYING SCHOOL—U. S. 1 and Douglas Sts., N.W., Wash., D. C., basic air corps flying school, incl. 27 barracks, 2 colored enlisted mens barracks, 11 cadets barracks, 10 dayrooms, 10 supply rooms, mess halls, cafeteria, 10 administration buildings, utlities, etc. $4,363,000.

Wash., Bremerton—RUNWAY, etc.—U. S. Eng., Central Bldg., Seattle, bids soon 150x4000 ft. runway, etc., for city. CAA. $234,000.

Wash., Bremerton — PARK — City, park. $100,000.

Wash., Bremerton—FUEL OIL HANDLING FACILITIES—Navy Dpt., 18 St. and Constitution Ave., N.W., Wash., D. C., fuel oil handling facilities at Puget Sound Navy Yard. $150,000.

★**Wash., Chehalis**—AIRPORT—U. S. Eng., Pittock Blk., Portland, Ore., bids soon 3,500x4,500 ft. airport runways, for city. CAA. $523,000.

Wash., Dallesport—AIRPORT—U. S. Eng., Pittock Block, Portland, Ore., bids 90 days, grading, draining, paving taxiways, for the city of Dalles, Ore. $180,000. CAA.

Wash., Ephrata—AIRPORT—U. S. Engineers, Pittock Block, Portland, Ore, bids 90 days, grading, draining, paving, 150x5,200 ft. runways, 50 ft. wide taxiways, for city, lights, $250,000 CAA.

†Wash., Oak Harbor—SEAPLANE RAMPS—Navy Dpt., 18 St. and Constitution Ave., N.W., Wash,. D. C., 4 seaplane ramps for new naval air station. $480,000.

†Wash., Seattle—GASOLINE STORAGE FACILITIES—Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., additional storage facilities, San Point Naval Air Station. $100,000.

Wash., Seattle—AIRPORT—U. S. Engineers, Central Bldg., bids 90 days, grading, paving, lighting, 50x5,150 ft. taxiway, co. airport, for King Co. $78,000. H. H. Sisler, County-City Bldg., engr. CAA.

Wash., Spokane—RUNWAY—U. S. Engineers, Pittock Block, Portland, Ore., paving, draining, and lighting, 150x4,300 ft. runway, Felts Field, municipal airport. $194,000. CD 8/1—ENR 8/7.

Ont., Centralia—FLYING SCHOOL—Dpt. Transport, Ottawa, service flying school, hangars, runways. $350,000.

Que., Lachine — AIR DEPOT — Dominion Government, Ottawa, Ont., constructing Manning Depot, frame buildings, concrete tanks, 25 Ave., for RCAF. $300,000. Dept. Air Defense, Ottawa, Ont., archt. Dpt. Munitions & Supply, Ottawa, Ont., engr.

Sask., Carlyle—AERODROME—Dpt. Transport and Dpt. National Defense for Air, Ottawa, Ont., relief intermediate aerodrome. $375,000.

Sask., Davidson—AIRPORT—Dpt. Transport and National Defense for Air, Ottawa, Ont., airport for S.F.T. School. $425,000.

†Alaska, Petersburg—AIRPORT—Civil Aeronautics Auth., Anchorage, airport with 2 runways, 500 ft. wide, 1 mi. long at Port Agassiz, near here.

†Alaska, Kodiak—OIL STORAGE—Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., fuel, diesel and lubricating oil storage for submarine base. $400,000.

†Alaska, Sitka—NAVAL AIR STATION—Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., additional buildings, accessories, Naval Air Station. $2,654,200.

BIDS ASKED

Bids after September 1

Minn., Warren—RURAL TRANSMISSION LINES—P. K. M. Electric Co-operative, Inc., 377 mi. rural electric transmission line, Polk, Marshall and Kittson Counties. $292,000. C. J. Halstad, engr.

Bids Asked September 8

Ark., Little Rock—APRON, TAXIWAY, etc.—U. S. Eng., Gay Bldg., apron, taxiway and draining at Adams Field Airport, Inv. 277-42-11.

†Wash., Vernita — SUBSTATION CONDENSER—Bonneville Power Admin., P. O. Box 3537, Portland, Ore., 30,000 kva. synchronous condenser for substation, Inv. 2237.

Bids Asked September 9

Calif., Oxnard—AIRPORT—U. S. Eng., 751 S. Figueroa St., Los Angeles, grading, paving at airport, for city. CAA. Over $25,000.

Bids Asked September 10

Iowa—RURAL ELECTRIC LINES—Woodbury County Rural Electric Cooperative Assn., D. Schriener, supt., Moville, 151 mi. rural electric lines. $115,000. Buell and Winter, Sioux City, engr. REA. CD 8/8—ENR 8/21.

†Utah, Wendover — CONTROL TOWER—U. S. Eng., 751 S. Figueroa St., Los Angeles, Calif., control tower at bombing range.

Bids Asked September 11

Ill., Chicago — VENTILATING — Dpt. Subways & Superhighways, 20 N. Wacker St., Contr. M-3, ventilating subways sys. Contr. M-3.

Bids Asked

†California — Bureau Reclamation, Customhouse, Denver, Colo., Aug. 15, fish rack and trap, Sacramento River, Balls Ferry, Kennett Div., Central Valley Project, Spec. 1538-D, from R. G. Clifford, 215 Market St., San Francisco. $68,369. CD 7/28—ENR 7/31.

LOW BIDDERS

★**†Calif., Moffett Field**—WIND TUNNEL—National Advisory Com. for Aeronautics Ames Laboratory, Moffett Field, Aug. 15, wind tunnel 40x80 ft. at smallest cross section from Pittsburgh-Des Moines Steel Co., Rialto Bldg., San Francisco, **$6,164,320.** CD 8/1—ENR 8/7.

Kan., Kansas City—Bd. P. Utilities, August 20, structure from low pumping station, from Carrothers & Crough, 7949 Broadway. $123,230. CD 7/29—ENR 7/31.

★**†Miss., Columbus** — FLYING SCHOOL—U. S. Eng., Customhouse and Courthouse Bldg., Mobile, Ala., Aug. 20, Army base training school, 148 buildings, etc., from V. P. Lotts Co., Builders Bldg., Charlotte, N. C., **$4,123,791.** CD 8/15.

†Ore., Bonneville — INTAKE GATES — U. S. Eng., Pittock Blk., Portland, Aug. 19, 16 steel intake gates for powerhouse at Bonneville Dam, Inv. 698-42-59, from Willamette Iron & Steel Wks., 2860 N.W. Front St., Portland **$495,040.** CD 8/1—ENR 8/7.

★**Wash., Seattle**—DRYDOCK—Todd-Seattle Shipbuilding Co., 1801 16 Ave., S.W., 900x10 ft. drydock, from General Constr. Co., 3440 Iowa St. Est. $1,000,000. CD 7/30—ENR 8/7.

★**†Washington** — TRANSMISSION LINE CONDUCTOR, etc. — Bonneville Power Admin., P. O. Box 3537, Portland, Ore., Aug. 18, conductor and accessories for Bonneville-Midway section Bonneville-Coulee, from Phelps Dodge Corp., 40 Wall St., New York, N. Y. **$818,437.** CD 8/13—ENR 8/31.

CONTRACTS AWARDED

★**Ariz., Phoenix**—LANDING MAT, etc.—U. S. Eng., 751 S. Figueroa St., Los Angeles, Calif., landing mat, etc., at Luke Field, Phoenix Military Airport, Litchfield Park, to Pearson & Dickerson Contractors, Inc., Oswald Bros. and J. A. Casson Co., Box 471, Prescott. **$924,690.**

Ark., Fort Smith—PARK IMPROVEMENTS—City, imprv. park and recreational area, WPA. Est. **$50,000.** W. D. O'Shea, Ft. Smith, engr.

Calif., Los Angeles—CONDUIT LINE—City Dpt. Water & Power, 207 S. Bway., Aug. 18,

UNCLASSIFIED (Contracts Awarded, Cont'd.)

7" duct conduit line, 12,449 ft. for electric power transmission from Harbor steam plant to receiving station (underground), to Fritz Ziebarth, 820 W. Esther St., Long Beach. **$147,000.** CD 8/5—ENR 8/7.

★**Calif., Permanente**—POWER LINES—Pacific Gas and Electric Co., 245 Market St., San Francisco, power line to feed magnesium plant. **$500,000.** Own forces.

★†**Calif., San Francisco**—NAVAL BASE—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., section base facilities at Treasure Island, San Francisco Bay (supplemental award), to Dinwiddie Constr. Co., Crocker Bldg., **$600,500.**

Ia., Iowa City—AIRPORT—Imprv. runways, Municipal Airport, **$115,000.** WPA.

★†**Me., Houlton**—AIR BASE—U. S. Eng., 1st and Douglas Sts., N.W., Wash., D. C., air base, to Caye Constr. Co., 356 Fulton St., Brooklyn, N. Y. Est. **$2,418,000.** CD 8/19—ENR 8/21.

★†**Me., Presque Isle**—AIR BASE—U. S. Eng., 1st and Douglas Sts., N.W., Wash., D. C., air base, to Caye Constr. Co., Inc., 356 Fulton St., Brooklyn, N. Y. Est. **$3,080,000.** CD 8/15—ENR 8/21.

★†**Mass., Chicopee Falls**—RUNWAYS—U. S. Eng., 819 Industrial Trust Bldg., Providence, R. I., paved runway, Westover Field, Inc. 699-42-28, to B. Turecamo, foot 24 Ave., Brooklyn, N. Y. **$532,041.** CD 8/19—ENR 8/21.

Mo., St. Louis—HANGAR—Whitefield Aircraft Corp., 315 N. 7 St., 1 story, 60x100 ft., brick hangar for airport, Hy. 61, Jefferson Co., to C. Kist, 2301 S. Kingshighway, St. Louis. B. Luer, 1155 Big Bend Boulevard, Richmond Heights, St. Louis, archt.

†**Nebraska**—SHELTERBELTS—Dpt. Agriculture, Forestry Serv., The Mall between 12 and 14 Sts. S.W., Wash., D. C., 500 mi. additional shelterbelts, **WPA.**

N. J., Bayonne—RECREATION AREA—city, excavating, grading, landscaping, etc., recreation area, WPA. **$71,500.** H. A. Jaeger, City Hall, City and WPA engr. CD 8/14—ENR 8/21.

†**N. J., Clark**—ARSENAL IMPROVEMENTS—Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., imprv. Lake Denmark Naval Arsenal, excavating, landscaping, concrete walls, etc. **WPA. $74,282.** CD 7/15—ENR 7/17.

†**N. J., Fort Dix**—ANTI TANK RANGE—Con. Q.M., electrically operated anti tank range incl. clearing 500 acres, etc., WPA, **$55,500.**

★†**N. Y., Brooklyn**—NAVY YARD—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., rehabilitating buildings, facilities and grounds at Navy Yard. **WPA. $829,000.** W. W. Johnstone, 70 Columbus Ave., New York, dir. Div. Operations.

N. Y., Buffalo—SHIPBUILDING PLANT—Niagara Shipbuilding Corp., 36 Washington St., shipbuilding plant, to Siegfried Constr. Co., 6 N. Pearl St. Est. **$400,000.** CD 7/2—ENR 7/10.

N. Y., Long Island City—ATHLETIC FIELD—Bd. Educ., 118 Livingston St., Brooklyn, imprv., constructing athletic field, addn. to boundary walks, courts, landsca ing, etc., at William Cullen Bryant H.S. and P.S. 125. WPA. **$129,703.** W. W. Johnstone, 70 Columbus Ave., New York, dir. Div. Oper.

N. Y., New York—GREENHOUSE, etc.—Dpt. Parks, Arsenal Bldg., 64 St. and 5th Ave., greenhouse, garage, storage, Zoological Park. **WPA. $98,894.** W. W. Johnstone, 70 Columbus Ave., dir. Div. Operations.

Okla., Cement—OIL PIPE LINE—Rock Island Refining Co., Duncan, 30 mi. 6 in. oil pipe line from Cement oil field to pumping station near Marlow, own forces. **$100,000.**

†**Okla., Fort Sill**—HARD STANDING AREAS—Con. Q.M., hard standing areas, to Standard Paving Co., 2119 E. 11 St., Tulsa, **$273,600.** Awarded 7/30.

†**Ore., Portland**—POWER LINE—Bonneville Power Project, 811 N.E. Oregon St., Aug. 13, Willamette River line crossing from St. Johns (Portland) to Linnton., C. J. Montag & Son, Couch Bldg., Portland, **$100,328.** CD 7/31.

Pa., Harrisburg—AIRPORT—U.S. Eng., 332 Post Office Bldg., Baltimore, Md., apron, taxi strip and driveway, etc., at Harrisburg municipal, Fairview Twp., York Co., to Donald T. Stabler, 3025 Derry St., Paxtang, **$45,481.** Bids 7/28. CD 7/16—ENR 7/24.

†**Pa., Indiantown Gap**—ARTILLERY RANGE—Con. Q.M., repairing sewers, water lines, roads, landing field and work on artillery range, WPA. **$426,340.**

Pa., Williamsport—REMOVING TRACKS—City, R. R. Rail, Dir. Streets, removal approx. 10,000 ft. rails, various streets, repaving, **$45,000** to **$50,000.** Lyons Mussina, city engr. Own forces.

S. C., Charleston—SHIP BUILDING SHOP, etc.—Dotterer Engr. Co., 21 Broad St., engrs., July 30, pier and railroad trestles; snagging, dredging, reconstruction, shipyard, from Charleston Constructors, Inc., Tradd St., and Adger Wharf, **$114,317** and **$34,441** respectively***slope protection for rebuilding shipyard, from C. Y. Thomason, Greenwood, **$43,800*****3 story, brick office bldg. and cafeteria, from R. B. Simmons, 14 Broad St., **$43,911,** for Charleston Shipbuilding & Drydock Co.,

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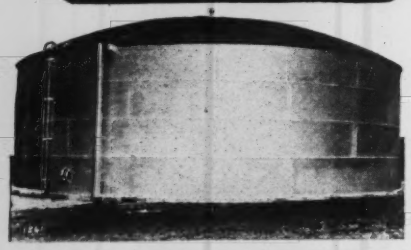

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UNCLASSIFIED (Contracts Awarded, Cont'd.)

106 Concord St. Grand total, **$236,469.** CD 7/21—ENR 7/24.

†Tenn., Tullahoma—HANGAR — Con. Q.M., A.C. hangar for 128 Observation Squad, Camp Forrest, to Frank G. Stewart & Co., Broad and Chestnut Sts., Phila., Pa. **$88,000.**

Tex., Fort Worth—HANGAR—S. H. Bothwell, city mgr., north hangar addn. municipal airport, to J. W. Padgett, 3616 Townsend Dr. **$43,387.**

†Tex., Palacios — SPORTS ARENA — Con. Q.M., Camp Hulen, sports arena, to R. H. Folmar, 110 E. 9 St., Austin. **$71,000.**

Alta., Kircaldy—AIRPORT—Dpt. Transport, Ottawa, Ont., airport for S.F.T. School, ground work, hard surfaced runways, taxi strips, grading, etc., to Tomlinson Constr. Co., Ltd., 2 Somerset Bldg., Winnipeg. **$175,000.**

N. B., St. John—SHIPBUILDING PLANT—St. John Dry Dock & Shipbuilding Co., Ltd., St. John, plant addn., 723 ft. fitting-out berth, to Canadian Dredge & Dock Co., Ltd., Harbour Comm. Bldg., Toronto, Ont. **$450,000.**

Ont., Hagersville—FLYING SCHOOL — Dpt. Natl. Defense for Air, Ottawa, frame buildings at S.F.T. School, to W. C. Brennan Contg. Co., Ltd., 400 Gage St., Hamilton. **$63,000.**

Ont., Kingston—FLYING FIELD—Dpt. Natl. Defense for Air, Ottawa, wood buildings on emergency flying field, to A. I. Garvock, Regent Bldg., Spark St., Ottawa. **$68,000.**

Ont., Sault Ste. Marie—DOCK REPAIRS—Canada Steamship Lines, Ltd., 715 Victoria Sq., Montreal, Que., repairing dock, to Richardson Constr. Co., Ltd., 10 Adelaide St. E., Toronto. **$25,000.**

Sask., Weyburn—AIRPORT—Dpt. Natl. Defense for Air, Ottawa, Ont., grading, hard-surfacing runways, taxi strips for S.F.T. School, to Bird Constr. Co., Ltd., 7 and Smith Sts. Regina, Sask. **$250,000.** CD 2/41—ENR 2/13.

LATIN AMERICA

South America, Brazil, Rio de Janeiro—Contract for construction 160x40 meters orange refrigeration plant was signed recently by Rio de Janeiro Administration, Byington & Cia., and Empressa de Construccoes Geraes, Ltda.

South America, Colombia, Medellin—Antonio Restrepo Alvarez, Edificio Lalinda, taking segregated bids 9 story 80x250 ft., rein.-con. hotel, for Nutibara Hotel Corp., Medellin. $750,000. P. R. Williams, 3839 Wilshire Blvd., Los Angeles, Calif., archt.

Mexico, Acapulco—Dpt. Communications & Pub. Bldgs., c/o Gen. H. Jara, army minister, Mexico City, semi-fireproof living quarters for increased personnel at Naval Base, force account and sub-contract, $250,000***plans housing for personnel at Navy Bases at Vera Cruz $300,000, and Ciudad del Carmen $200,000.

Mexico—Mexican Federal Government, c/o Dpt. Communitions, Mexico City, abandoned (at least temporarily) construction new International Railway bridge across Rio Grande River between Nuevo Laredo, Mexico, and Laredo, Tex. $100,000. CD 11/14.

Mexico, Mexico City — Bruno Paglia, c/o Scrita. de Hacienda, Mexico, D. F., plans horse race track, incl. clubhouse, grandstand, paddock. $215,000. Work starts within 30 days.

Mexico, Mexico City—Owner, c/o S. Charles Lee, archt., 1648 Wilshire Blvd., Los Angeles, Calif. and 122 Avenita Monteirdo, Mexico, D. F., Mexico, completed plans theatre, 1200 seating capacity, also preparing plans 3 theatres and 4 story apartment. $2,000,000.

Mexico, Matamoras—Dpt. Communications & Pub. Bldgs., c/o M. Suarez, secy. Finance, Mexico City, awarded contract grading, building concrete bridge structures between Matamoras and San Fernando, to James Iglesias, Brownsville, Tex., **$320,000.**

Mexico, Piedras — Dpt. Communications & Pub. Wks., c/o E. F. Suarez, secy. Finance, Mexico City, and town of Piedras, paving city streets, purchase and hire. $300,000.

Mexico, Tijuana — Dpt. Communications & Pub. Wks., c/o E. F. Suarez, secy. Finance, Mexico City, bids soon, road and concrete bridges along Rumorosa Hts. between Tijuana and Mexicali, approx. 45 mi., $400,000 and $200,000 respectively; also constructing 125 mi. permanent highway and several concrete bridges on road between Mexicali and San Felipe, $1,000,000 and $500,000 respectively*** Dpt. Communications & Pub. Bldgs., c/o Gen. H. Jara, Mexico City, plans constructing quarters to house personnel attached to Navy Base, $225,000.

PUBLIC BUILDINGS

PROPOSED WORK

Ala., Montgomery — Montgomery Housing Auth., 44 unit housing. $160,000. R. J. Adams, 21 S. Lawrence St., and E. G. Lutz, 313 Catoma St., Ala., archt.

★**†Arkansas**—Aluminum Co. of America, Gulf Bldg., Pittsburgh, Pa., plans aluminum smelter, annual capacity 100,000,000 lb., $11,000,000; aluminum plant, 400,000 lb. annual capacity, $13,000,000, both for War Dpt. Defense Plant Corp. will finance. Site not selected.

Ark., North Little Rock—Sch. Bd., 24 and Main St., combined cafeteria, auditorium, $180,167.

Ark., Little Rock—State hospital grounds, University of Arkansas, Medical Sch., $150,000.

†Calif., Fort Ord—Con. Q.M., detention wards.

†Calif., Lemoore—U. S. Eng., 20 Postoffice Bldg., Sacramento, regimental chapel at flying school.

†Calif., Merced—U. S. Eng., 20 Postoffice Bldg., Sacramento, regimental chapel at flying school.

†Calif., Muroc—War Dpt., 20 St. and Constitution Ave. N.W., Wash., D. C., armament and instrument inspection and adjustment building, Muroc Bombing Range. $176,000.

†Calif., Marysville—War Dpt., 20 St. and Constitution Ave., N.W., Wash., D. C., irr., angular camp. Lippincott & Bowen, 541 Petroleum Security Bldg., Los Angeles, archts. and engrs. CD 7/22—ENR 7/24.

Calif., San Francisco—City and San Francisco Co., rein.-con. gymnasium for girls, Lowell High School $150,000, for boys and girls, Abraham Lincoln High School $250,000. Municipal Dpt. Architecture, City Hall, archt.

Calif., San Francisco — Housing Auth. of City and County of San Francisco, 525 Market St., rejected bids July 29, 220 dwelling unit, Bernal Dwellings, Proj. Cal. 1-5. Will readvertise. CD 8/6—ENR 8/7.

†Calif., Santa Monica—Douglas Aircraft Co., Inc., 3000 Ocean Park Blvd., constructing, equipping plant for War Dpt. $447,976 for land and buildings, $74,200 for machinery and equip. Defense Plant Corp. will finance.

†Calif., Stockton—U. S. Eng., 208 Postoffice Bldg., Sacramento, regimental chapel at Stockton Flying School.

Conn., Bridgeport—J. J. Galla, supt. Welfare Dpt., sketches by H. G. Lindsay, 211 State St., archt., 2 wing, 150 bed capacity, and 20 room nurses home addn., 40 room male attendants, and Interne's dormitory, Hillside Home, hospital expansion. Over $150,000.

Conn., Groton—Town, Bd. Alderman, Town Hall, 2 story, bsmnt., brick, steel, school, Pleasant Valley, $150,000. E. L. Scholfield, 309 State St., New London, engr.

Conn., New Britain—Dpt. P. Wks. plans by H. F. Ludorf, 410 Asylum St., Hartford, 2 story, brick, steel fire-police station, Main and East Main Sts. $150,000. CD 7/30—ENR 8/7.

Del., Newport—Power plant. Over $160,000.

Del., Talleyville—Alfred I. du Pont School Dist., Concord Pike, Talleyville, plans by Massena & du Pont, 704 Delaware Ave., Wilmington, school addn. $150,000.

†D. C., Bolling Field—U. E. Eng., Wash., D. C., post headquarters and operations building. $300,000.

★**D. C., Wash.**—Dist. Comrs., Dist. Bldg., 5 story, hospital, Arlington County, Va., $1,260,000; additional building for Garfield Hospital $2,500,000; new 600 bed addn. to Columbia Hospital, $4,000,00. Applied for PWA funds.

†Ill., Great Lakes—Navy Dpt., 18 St. and Constitution Ave., N.W., Wash., D. C., theatre and chapel, Great Lakes Training Base, $100,000. Rapp & Rapp, 230 N. Michigan Ave., Chicago, archts.

★**†Ill., Joliet**—War Dpt., 20 St. and Constitution Ave., N.W., Wash., D. C., additional storage facilities at ordnance loading plant $825,000.

†Ill., Savanna—War Dpt., 20 St. and Constitution Ave., Wash., D. C., storage garage $80,000, carpenter shop $35,000, completion heating plant $30,653; paint and storage building $21,000, etc. Ordnance depot.

Ind., Fort Wayne—Con. Q.M., housing for non-commissioned officers at base. $283,000.

★**†Ia., Burlington**—War Dpt., 20 St. and Constitution Ave., N.W., Wash., D. C., additional storage facilities at ordnance loading plant. $562,000.

Ia., Murray—Power plant and distr. sys. $80,000. A. S. Harrington, Baum Bldg., Omaha, Neb., engr.

Ia., Rock Rapids—Power plant imprv. diesel generator. $75,000.

Ky., Corbin—Corbin Housing Comn., bids in October, 1 and 2 story housing. $260,000. H. Meriwether, 234 E. Short St., Lexington, archt. CD 7/24—ENR 7/31.

Ky., Henderson—R. B. Posey, mayor, plans by Colley & Hartstern, Realty Bldg., Louisville, 3 story hospital. $160,000.

★**†Ky., Morganfield**—War Dpt., 20 St. and Constitution Ave. N.W., Wash., D. C., camp. $22,800,000. Warren & Ronald, Heyburn Bldg., R. W. Chanaberry, Inc., Realty Bldg., and Colley & Hartstern, Realty Bldg., all Louisville, also Associated Architects and Engineers of Lexington, engrs. CD 7/22—ENR 7/24.

Ky., Somerset—Somerset Municipal Housing Comn., c/o W. C. Norfleet, mayor, plans by H. Meriwether, 234 E. Short St., Lexington, 34 unit low cost housing. $150,000.

†La., Leesville—Public Bldgs. Administration, Wash., D. C., Aug. 15, 175 defense housing units, Camp Polk, from Sailey & Ellis, Monroe, Bid (1) $514,895, (2) $520,195. CD 8/12.

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PUBLIC BLDGS. (Proposed Work, Cont'd.)

Md., Annapolis — Anne Arundel Co. Bd. Educ., sketches completed by Buckler & Fenhagen, 325 N. Charles St., Baltimore, school. $164,000.

★**†Mass., Chicopee**—Chicopee Housing Auth., O. A. Savaria, chn., 64 Center St., Aug. 20, 300 defense housing units, project 19022-N, for USHA, from John Bowen Co., 129 Newbury St., Boston. **$1,138,000.** CD 8/13.

†Mass., Springfield—Con. Q.M., Springfield Armory, plans by J. R. Wooster & Co., 79 Milk St., Boston, brick, steel plant addn. for manufacture gunstocks, $400,000; plans by M. W. Maloney, 220 Dwight St., Springfield, addn. ballistic building incl. shooting range, $150,000.

†Mich., Battle Creek—Bd. Educ., addn. to Urbandale Elementary and Junior High School, Docket 20-103, $198,000. **FWA.**

★**Mich., Lansing**—O. Eckert, supt. Water & Light Comrs., plans brick, steel, rein.-con. power plant addn., 25,000 kw. turbine generator and boiler. $3,000,000.

★**Mich., Ypsilanti**—Bd. Educ., plans by R. S. Gergaboff, Ypsilanti, three 2 story, bsmnt., brick, steel, rein.-con., stone school addn. $1,350,000.

Miss., Pascagoula—Bd. Supervs., c/o K. W. Burnham Prest, Moss Point, Court House Building. $350,000.

★**Mo., Normandy** — Normandy Consolidated School Dist., c/o Supt. Schools, 6701 St. Charles Rock Rd., Normandy, St. Louis, three brick, concrete and stone grade school, 1 jr. high school, 1 high school. $1,036,500. W. B. Ittner, Inc., 408 Bd. Educ. Bldg., 911 Locust St., archt.

Mo., Pattonville—Pattonville P. School Dist., c/o Supt., St. Charles Rock Rd., St. Louis Co., brick, concrete school bldg. $154,088. Applied PWA funds.

†Mo., St. Charles—Farm Security Administration, c/o Dis. Eng., Court House, St. Charles, rejected bids July 22, 60 housing units, north of village Dardenne, St. Charles Co. CD 8/13—ENR 8/21 under LB.

†Mont., Fort Peck—U. S. Eng., 10 E. 17 St., Kansas City, Mo., superstructure power house at Fort Peck Dam.

†Nev., Las Vegas—U. S. Eng., 751 S. Figueroa St., Los Angeles, Calif., guest house at military airport.

★**†New Jersey**—War Dpt., 20 St. and Constitution Ave., N.W., Wash., D. C., terminal facilities for lend-lease supplies Caven Point, New Jersey. Frederick Snare Corp., 114 Liberty St., New York, N. Y., archt. and engr.

★**†N. J., Belleville**—Isolanite, Inc., 343 Cortlandt St., plans for manufacture radio equip., for War Dpt., $275,000 for land and buildings, $697,774 for machinery and equip. Defense Plant Corp. will finance. Parkinson Co., 222 S. 12 St., Newark, engrs. and archts. CD 8/25.

★**†N. J., Clifton**—Public Bldgs. Admin., 9 and D St., S.W., Wash., D. C., 150 units defense housing project, Valley Rd., for aircraft plant. $500,000.

†N. J., East Paterson—Public Bldgs. Admin., 9 and D Sts., S.W., Wash., D. C., 100 unit defense homes project, Market St., aircraft plant. $350,000.

†N. J., Fort Dix—Con. Q.M., 2 community buildings. $164,390.

★**†N. J., Linden**—Lawrence Eng. & Research Corp., Vreeland Mill Rd., plant for manufacture aircraft equipment, $322,000 for land and buildings, $341,000 for machinery and equip., for Navy Dpt. Defense Plant Corp. will finance.

★**N. J., Ridgewood**—Ridgewood Hospital Assoc., 180 Lincoln Ave., plans by G. Nordham, 241 Main St., Hackensack, 3 and 4 story, bsmnt., 130x260 ft., brick, rein.-con. hospital, N. Van Dien Ave. $1,000,000.

★**†N. Y., Massena**—Aluminum Co. of America, Gulf Bldg., Pittsburgh, Pa., plans aluminum smelter, annual capacity 150,000,000 lb. for War Dpt. **$14,000,000.** Defense Plant Corp. will finance.

N. C., Morehead City—Morehead City General Hospital, 100 room addn. $180,000.

★**N. C., Rocky Mount**—City, L. B. Aycock, city mgr., expans. Power Plant. $805,000.

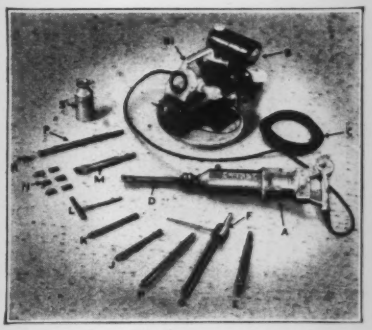
O., Cleveland—Bd. Educ., Wallace G. Nesbit, dir., 1749 Lee Rd., school, Belvoir Blvd. and Milton Rds. $150,000.

★**†O., Ravenna**—War Dpt., 20 St. and Constitution Ave., N.W., Wash., D. C., additional storage facilities at ordnance loading plant. $977,500.

†O., Ravenna—Comrs. Portage Co., hospital addn. and nurses' home, Docket 33-101. $250,000. **FWA.**

★**†Ore., Bonneville**—Aluminum Co. of America, Gulf Bldg., Pittsburgh, Pa., plans aluminum plant, annual capacity 90,000,000 lb., for War Dpt. $11,000,000. Defense Plant Corp. will finance.

†Pa., Wilkes-Barre—National Youth Administration, 15 St. and New York Ave., Wash., D. C., 56x140 ft. workshop with 20x140 ft. wing, incl. boiler plant welding shop and office, owner builds. CD 8/7—ENR 8/14.



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PUBLIC BLDGS. (Proposed Work, Cont'd.)

Tenn., Jackson—c/o A. Milde, Madison Co., judge, imprv. high school. $150,000.

Tenn., Nashville—City, c/o T. L. Cummins, mayor, fire tower and fire hall, bonds to be issued. $200,000.

†Tenn., Nashville—Tennessee Products Corp., Amer. Natl. Bank Bldg., reconditioning ferromanganese furnace, for Navy Dpt. $150,000. Defense Plant Corp. will finance.

Tex., Alpine—Brewster Co., 1 story, brick, steel steam heating plant. $40,000. V. J. Smith, Box 158, Alpine, engr.

Tex., Austin—State Health office, c/o Dr. G. W. Cox, Austin, plans by Shingle & Scott, Littlefield Bldg., 4 story addn. to 1 story building and top addn. to present building. $308,500. Applied for federal funds.

†Tex., Fort Worth—War Dpt., 20 St. and Constitution Ave. N.W., Wash., D. C., recreational camp buildings, utilities, etc. $200,000.

Tex., La Marque—Bd. Educ., F. Junerman, pres., plans by L. C. Cato, 500 Stewart St., Houston, land 2 story, brick, tile school, Tex. 41-252. $308,000. Applied for PWA funds. CD 6/19—ENR 6/26.

Tex., Midland—Town, buildings for training school. $100,000.

Tex., Wichita Falls—Bd. Educ. plans by Voelker & Dixon, 913½ Indiana Ave., 2 Junior High School. CD 6/18—ENR 6/26.

★**†Utah, Salt Lake City**—Remington Arms Co., Inc., J. H. Chasmar, mgr. military operations, Barum Ave., Bridgeport, Conn., ordnance plant, 100 buildings (third plant) for manufacture of firearms, for War Dpt. $18,500,000 for construction, $11,985,000 for machinery.

†Va., Newport News—City of Newport News, fireproof recreation building incl. out-door swimming pool, etc., Docket 44,123. $398,000. FWA.

Va., Richmond—City, H. Dickins, 2 story school addn., Twenty-first and T Streets. $300,000. Baskerville & Son, Central National Bank Bldg., archts.

†Vt., Brattleboro—American Optical Co., Mechanic St., Southbridge, Mass., brick, steel, lense grinding plant. $300,000. Defense Plant Corp. will finance.

★**†Wash., Bremerton**—Navy Wpt., 18 St. and Constitution Ave. N.W., Wash., D. C., exten. storehouse at Puget Sound Navy Yard. $500,000.

†Wash., Bremerton—Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., exten. Bldg. 434 at Puget Sound Navy Yard. $145,000.

Wash., Port Orchard—School Bd., 1 story brick school, $238,000. G. W. Stoddard, New Orpheum Bldg., Seattle, archt. PWA aid.

★**†Wis., Greenfield**—Allis Chalmers Mfg. Co., 1126 S. 70 St., Milwaukee, plant for production bomber equip., $4,105,438 for land and buildings, $4,961,526 for machinery and equip., for War Dpt. Defense Plant Corp. will finance.

Wis., Menomonie—Bd. Educ., $225,000 election, Sept. 9, high school, W. J. Ingemann, 210 Anchor Pl., St. Paul, archt. CD 4/17—ENR 4/24.

Wis., Viroqua—Vernon Co., plans by J. D. Durant, Boscobel, 80x160 ft., hy. garage, con. fdn. $45,000. C. Hoff, co. engr.

Wis., Whitefish Bay (Milwaukee P. O.)—School Dist. 1, 5800 N. Maitland Ct., plans by H. W. Tullgren, 1234 N. Prospect Ave., 2 story, 110x160 ft., brick, con. steel gymn. addn. to High School. $300,000.

†Alaska, Ketchikan—Treas. Dpt., Wash., D. C., bids soon, addn. coast guard base. $30,000.

Que., Quebec City—Provincial Government, Quebec City, additional wing to Technical School, Blvd. Langelier. $150,000. Dpt. Prov. Secy., Parliament Bldg., archts.

BIDS ASKED

Bids Asked September 3

†La., Lake Providence—Farm Security Admin., Little Rock, buildings for farmstead units.

O., Richmondale—Southeastern Rural School Dist., M. Weaver, clk., high school. $220,000. Walker, Norwick & Templin, American Bldg., Dayton, archts.

★**†Pa., Phila.**—Yards & Docks, Navy Dpt., Wash., D. C., warehouse at Navy Yard. $3,000,000. CD 5/29—ENR 6/5.

Utah, Moroni — Town, F. Draper, mayor, diesel powered electric light and power plant. H. Bletzacker, Murray, engr.

Bids Asked September 4

La., St. Joseph—Farm Security Admin., Little Rock, buildings for farmstead units.

Bids Asked September 5

O., Mariemont—U. S. Eng., Post Office Bldg., Cincinnati, testing laboratory on U. S. Reservation.

Bids Asked September 8

Mich., Wyandotte—Municipal Service Comn., municipal power plant, contr. 7, power wiring, 8, installation power piping, over $100,000. Burns & McDonnell, 107 W. Linwood Blvd., Kansas City, Mo., engrs. CD 7/31—ENR 8/7.

Bids Asked September 8

Tex., Dallas—Dallas Housing [illegible] Lucas Dr., Frazier Courts low [illegible] Housing project, Tex. 9-5. CD 6/12—ENR [illegible] under LB.

Bids Asked September 9

†S. C., Parris Island—Navy Dpt. [illegible] St. and Constitution Ave., N.W., Wash., D. [illegible] 20 officers quarters at Charleston Navy [illegible] and 30 officers quarters at marine barracks, Parris Island. Former bids rejected. CD [illegible]—ENR 8/7 under LB.

Bids Asked September 11

Mich., Royal Oak—Bd. Ed., 709 N. Washington Ave., Northwood and Whittier School additions. F. D. Madison, 236 Wayne-Oakland Bank Bldg., archt.

O., Hamilton—City, new steam boilers for power & light plant, N. Third St. $252,900. Froelich & Emery, Toledo, engrs.

Bids Asked September 16

★**Calif., Sacramento** — Sacramento Housing Auth., 115 City Hall, plans by H. J. Devine, Cronan Bldg., C. F. Dean, Calif. State Life Bldg., and L. F. Starks, Bank of America Bldg., 160 unit, Dos Rios Low-Rent Housing Project, (7-1). $560,000. Extend date. Noted CD 8/3—ENR 7/24.

†Idaho, Boise—U. S. Eng., Pittock Blk., Portland, Ore., 38x109 ft. warehouse, 2849 ft. heating plant and lavatory building, 35 97 ft. ammunition assembly shop, 38x144 ft. trailer shed, 4 magazine buildings and 6 barricaded steel igloos for Airport. CD 7/16—ENR 7/24.

Bids Asked

†Calif., Watsonville—Con. Q.M., Fort Ord, recreation building, etc., Camp Mecquaide.

★**†Tex., Amarillo**—Bureau Mines, C St. between 18 and 19 Sts., N.W., Wash., D. C., extending helium plant. $1,250,000.

Bids Asked September 15

★**†Tex., San Antonio**—U. S. Eng., Federal Bldg., Galveston, hospitalization and medical buildings and utilities, Kelly Field. $642,570. CD 8/13—ENR 8/21.

LOW BIDDERS

★**Ark., Little Rock**—Little Rock Housing Auth., 911 Wallace Bldg., Aug. 21, 76 unit housing project (4-1); 74 unit housing project, (4-2) and 100 unit housing project (4-3) from Harmon Constr. Co., 1128 N.W. 4 St., Oklahoma City, Okla., $788,887. CD 8/12.

★**Calif., Los Angeles**—Housing Auth., 1031 S. Bway., Aug. 19, Rancho San Pedro Housing Project from Aetna Constr. Co., 621 S. Witmer St. **$988,663.** CD 8/12—ENR 8/14.

†Fla., Panama City—Public Bldgs. Admin., 9 and D Sts. S.W., Wash., D. C., Aug. 15, 150 defense units at Gunnery Flying School, from Edward S. Moore & Sons, Times Bldg., St. Petersburg. **$374,700.** CD 8/12.

★**†Ill., Scott Field**—U. S. Eng., 816 U. S. Court House and Customhouse, Aug. 15, St. Louis, Mo., 37 mobilization buildings, reception center, barracks, mess halls, officers' quarters, etc., from National Builders, Inc., 2114 Foshay Tower, Minneapolis, Minn. **$518,584.** CD 8/4—ENR 8/7.

★**†Md. Curtis Bay (Sta. Baltimore)**—Baltimore Housing Auth., 709 E. Eager St., Baltimore, Aug. 18, 300 defense housing units, Project 18096-X for USHA, from Natl. Excavation & Structures Corp., 10 East 40 St., New York, N. Y., $1,119,000. CD 8/12—ENR 8/14.

★**†Md., Curtis Bay-Fairfield (Sta. Baltimore)**—Baltimore Housing Auth., 709 E. Eager St., Baltimore, Aug. 18, 500 defense housing units, Project 18097-X for USHA from Woodcrest Constr. Co. and Rosoff Bros. Inc., 340 East 38 St., New York, N. Y. $2,228,000. CD 8/12—ENR 8/14.

†Md., Forest Glen—Public Bldgs. Admin., 9 and D Sts., S.W., Wash., D. C., Aug. 22, 76 housing units for Army Medical Corps, from Harwood-Nebel Constr. Co., 1520 K St. N.W., Wash., D. C., $317,000 (90 day basis) $297,000 (110 day basis) (CD 8/18.

★**†Mich., Centerline**—United States Housing Auth., F St. between 18 and 19 Sts., N.W., Wash., D. C., 84 defense housing buildings, from O. W. Burke Co., 1010 Fisher Bldg., Detroit, $1,893,800. CD 8/13.

N. Y., Pine Bush—Bd. Educ., School Dist. 1, school, from E. Ossie, Highland. $187,000. CD 5/5—ENR 5/8.

†O., Dayton — Veterans Admin., Arlington Bldg., Wash., D. C., Aug. 19, domiciliary theatre bldg., 29, from David Gordon Building & Constr. Co., 3493 Burnet St., Cincinnati. $354,000. CD 7/18—ENR 7/24.

★**†O., Warren**—United States Housing Auth., F between 18 and 19 Sts. N.W., Wash., D. C., Aug. 20, 150 defense housing units from Heller-Murray Constr. Co., 222 W Rayen Ave., Youngstown, $502,869. CD 8/13.

★**Pa., Phila.**—Philadelphia Housing Auth., 21 St. and Parkway, Aug. 19, 1,000 residences, 20 and Packer Sts., from M. Shapiro & Son Constr. Co., 755 7th Ave., New York, N. Y. $4,387,000. CD 11/20—ENR 11/28.

PUBLIC BLDGS. (Low Bidders, Cont'd.)

★**R. I., Providence** — Providence Housing Auth., D. Barry, chn. 4 Weybosset St., 120 Dwelling unit, Codding Court, proj. RI 1-3 and 278 dwelling unti Admiral Terrace Housing proj., USHA. RI 1-1A, from M. Spinelli & Son, 38 Chauncey St., Boston, Mass. $1,291,000 and $550,000 respectively. CD 7/31—ENR 8/7.

★**Wash., Seattle.**— Seattle Housing Auth., Central Bldg., Aug. 18, 500 defense housing units on Sears tract, east of Jefferson Park Golf Course, for USHA, from Western Constr. Co., Textile Tower. **$1,704,000.** CD 8/13.

CONTRACTS AWARDED

★**Calif., Los Angeles** — Bureau Power & Light, 207 S. Bway., tandem compound steam turbine electric generator unit for Harbor Steam Plant, Spec. 3810, to Westinghouse Electric & Mfg. Co., 420 S. San Pedro St. **$1,021,682.** CD 7/24—ENR 7/31.

†**Colo., Denver**—War Dpt., 20 St. and Constitution Ave. N.W., Wash., D. C., repair shop, warehouse, firehouse, at Fitzimmons General Hospital. WPA. **$109,350.**

★†**Conn., Bridgeport**—Federal Works Agency, Wash., D. C., 250 defense housing units, Evers St., Conn. 6053-X, to A. Barbarisi & Sons, Inc., and August Severious, 20 E 1 st., Mt. Vernon, N. Y., **$773,000.** CD 8/21.

†**D. C., Wash.**—Alley Dwelling Auth., Farm Credit Bldg., Wash., D. C., 350 dwelling units (Highland Dwellings) Atlantic and 8 Sts., Condon Tearrace, S.E., for civilian employeed of U. S. Navy Yard, to Jeffress-Dyer, Inc., 1719 Milk St. N.W., **$1,288,602.** CD 8/21.

†**Ga., Macon** — Reynolds Corp., additional buildings at Naval Fuse Plant, to Mion Constr. Co., 377 Techwood Dr., N.W., Atlanta. **$483,000.**

★†**Ill., Carbondale** — Sherwin-Williams Co., A. W. Stendel, pres., 101 W. Prospect Ave., Cleveland, O., shell and bomb loading plant, known as Illinois Ordnance Plant, Crab Orchard Lake, 8 mi east here, for War Dpt., to Hunkin-Conkey Constr. Co., 1740 E. 12 St., Cleveland, O. Est. **$27,600,000.** CD 8/15—ENR 8/21.

Ill., Western Springs—School Dist. 106, Plainview school addn. to Rubertson Constr. Co., 127 N. Oak Park Ave., Oak Park. Est. **$150,000.** H. J. Harman, archt.

★†**Kan., Parsons**—War Dpt., 20 St. and Constitution Ave. N.W., Wash., D. C., shell loading plant, to Peter Kiewit Sons Co., Omaha Natl. Bank Bldg., Omaha, Neb., George W. Condon Co., Grain Exch. Bldg., Omaha, Neb., and Paschen Bros. Constr. Co., 221 N. LaSalle St., Chicago, Ill., cost plus fee basis. Est. **$20,000,000.** J-M Service Corp., subsidiary Johns-Manville Corp., 22 East 40 St., New York, N. Y., will operate. Consoer, Townsend & Quinlan, 211 W. Wacker Dr., and Battey & Childs, 231 S. LaSalle St., both Chicago, Ill., engrs. CD 8/15—ENR 8/21.

★†**Me., Bath**—Public Bldgs. Admin., Wash., D. C., 200 single units, 1 and 2 story, 26x75 ft., 52x70 ft. and 25x50 ft., to Stewart & Williams, Inc., 5 Wade St., Augusta. **$699,000.** CD 7/3—ENR 8/7.

★†**Mass., Hingham**—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., expansion facilities, Naval Ammunition Depot, to T. Stuart & Sons Co., 70 Philips St., Watertown, Mass. **$2,600,000.** Correction—address of contractor.) CD 8/11—ENR 8/14.

★†**Mass., Lynn**—General Electric Co., 920 Western Ave., 1 story, brick, steel gear plant, 250,000 sq. ft. floor space, for Navy Dpt., to Turner Constr. Co., 38 Newbury St., Boston. Est. **$2,000,000-$3,000,000.** Defense Plant Corp. will finance. CD 8/1.

Mo., Columbia—City, 75,000 lb. per hr. cap. steam generating unit, connection power plant imprv., to Springfield Boiler Co., Springfield, Ill. **$122,300.** Bids Aug. 18. CD 7/25—ENR 7/31.

N. J., Irvington—2 story, bsmnt, brick, limestone, town hall, Clinton Ave. gen. contr. to Fatzler Constr. Co., 653 S. 15 St., Newark, **$219,921.** CD 7/22—ENR 7/24.

★**N. Y., Brooklyn**—Dpt. P. Wks., Municipal Bldg., New York, general contract Brooklyn Terminal Market, to Federal Constr. Corp., 101 Park Ave., New York, **$1,067,700*****plumbing, to Astrove Plumbing & Heating Co., 369 Bway., New York, **$92,170*****electric, to Bank Electric Co., 126 W. 32 St., New York, **$51,200*****sewer, to A.F.M. Contr. Co., 1209 61 St., **$29,950*****heating, to Jacobs Eng. Co., 103 Park Ave., New York. Grand total **$1,246,147.** CD 7/23—ENR 7/31.

N. Y., Long Island City—Bd. Educ., 118 Livingston St., Brooklyn, imprv., constructing athletic field, addn. to boundary walks, courts, landscaping, etc., at William Cullen Bryant H.S. and P.S. 125. WPA. **$129,703.** W. W. Johnstone, 70 Columbus Ave., New York, dir. Div. Oper.

N. Y., New York—Dpt. Hospitals, 125 Worth St., altering main building, Harlem Hospital, WPA. **$187,467.** W. W. Johnstone, 70 Columbus Ave., dir. Div. Operations.

†**N. Y., New York**—Veterans Administration, Vermont Ave. between H and I Sts., N.W., Wash., D. C., altering chapel and buildings, garage addns., laundry, parking area, roadway, at Veteran Hospital, Bronx Co., WPA. **$112,625.** W. W. Johnstone, 70 Columbus Ave., dir. Div. Operations.

O., Dayton—Airport photographic laboratory—U. S. Eng., Wright Field, photographic laboratory, Wright Field, to Simpson Constr. Co., 1113 S. Hermitage St., Chicago, Ill., **$79,900.** CD 3/3—ENR 3/6.

Pa., Millvelll—National Youth Admin., 15 St. and New York Ave., Wash., D. C., 1 story, steel, concrete vocational training shop, N.Y.A. labor and separate contracts. Est. **$50,000.** CD 8/19—ENR 8/21.

Pa., Phila.—Philadelphia Housing Auth., 21 St. and Parkway, defense projects for USHA, to J. A. J. Constr. Co., 268 41 St., Brooklyn, N. Y., 700 units 36014X **$2,997,000;** 500 units 36015X **$1,942,000;** 200 units 36016X **$793,000.** Grand total $5,732,000. CD 7/29—ENR 7/31.

★†**Tex., Freeport**—Dow Chemical Co., Freeport, and Midland, Mich., synthetic ammonia producing plant to Austin Co. and M. K. Kellogg Co., M & M Bldg., Houston, **$11,000,000.** Defense Plant Corp. will finance. CD 8/11—ENR 8/14 under Industrial.

W. Va., South Charleston—South Charleston Housing Auth., South Charleston, Aug. 15, 400 defense housing units for employees of Naval Ordnance Plant, to Skilken Bros., 44 E Broad St., Columbus, O. **$1,511,457.** CD 7/10—ENR 7/17 under Charleston.

★**B. C., North Vancouver** and **Prince Rupert** —Wartime Housing Ltd., 55 York St., Toronto, Ont., 200 single family dwelling and 2 staff houses, North Vancouver, to Smith Bros. & Wilson, Ltd., 1267 Richards St., Vancouver; 126 single family dwellings and 2 staff houses at Prince Rupert, to E. J. Ryan Constr. Co., Ltd., 445 Granville St., Vancouver. Est. **$1,000,000.**

Ont., Dundas—War Time Housing Ltd., 55 York St., Toronto, general contract forty-two frame residences, 22x28 ft., 22x24 ft. and 22x25 ft., York Rd., to Frank Vansickle, 332 King St. W., Toronto.

Ont., Ottawa—Dpt. P. Wks., Ottawa, temporary office Bldg. 5, Preston and Carling Aves., to Pigott Constr. Co., Ltd., 811 Pigott Bldg., Hamilton. **$435,050.** CD 8/5—ENR 8/14.

Que., Montreal—Perrault & Gadbois, archts., 3795 Van Horne Ave., 3 story school, for College Stanislaus, Inc., McEachran Ave., to Heraux & Robert, Ltd., 1414 Crescent St. About **$200,000.** CD 7/22.

Que., Quebec City—Province of Quebec, Quebec St., garage repair shop, Devarennes St., to E. Frenette, 75 St. Lawrence St. **$40,000.** CD 5/14—ENR 5/29.

COMMERCIAL BUILDINGS

PROPOSED WORK

Calif., South San Francisco—E. Cornblum c/o C. W. Claudius, archt., 2443 47 Ave., San Francisco, (1st unit) homes, incl. thirty 1 story wood frame homes, Baden area, (ultimately 300 homes). $250,000.

Colo., Denver—St. Luke's Hospital, 1933 Pearl St., plans by R. Linder, Insurance Bldg., 3 story, brick hospital addn., E. 20 Ave. and Pennsylvania St. $350,000. CD 2/21—ENR 2/27.

★**Conn., Bridgeport**—Bridgeport Hospital, Grant St., Oliver, H. Bartime, supt., plans by Stevens, Curtin, Mason & Riley, 45 Newbury St., Boston, 3 story, bsmnt, 45x150 ft., brick, steel hospital addn., with connecting wing, also nurses home addn., Mill Hill Ave. $875,000. CD 8/19—ENR 8/21.

★**Conn., Hartford**—V. Gallagher, c/o W. Lescaze archt., 211 E. 48 St., New York, 1½ story, 200 single dwellings. $700,000.

★**Conn., Waterbury**—V. Gallagher, c/o W. Lescaze, archt., 211 E. 48 St., New York, 1½ story, 200 frame homes. $700,000.

Ind., Anderson—Sisters of the Holy Cross, 20 and Jackson Sts., plans by Schmitt, Garden and Erickson, 104 S. Michigan Blvd., Chicago, Ill., 4 and 5 story, brick, concrete hospital addn., St. Johns Hospital, 2001 Jackson St. $300,000. CD 2/6—ENR 2/15.

Ind., Indianapolis—American Building Co., 129 East Market St., 75 to 100 homes. Over $350,000.

Ind., Indianapolis—George Bruce Builders, 233 East Ohio St., 40 or more homes. Over $150,000.

Ind., Indianapolis—Wides Bros., 1200 E. 54 St., 30 or more homes, $150,000 or more.

Kan., Kansas City—Providence Hospital, 18 and Barnett Sts., 50 bed hospital addn. $300,000. Applied for PWA funds.

Kan., Kansas City—St. Margaret's Hospital, 8 and Vermont St., 50 bed hospital addn. $270,000. Applied for PWA funds.

Kan., Kansas City—Douglas Hospital, 336 Quindaro Blvd., 50 bed hospital for negroes, $377,533. Applied for PWA funds.

★**Md., Baltimore**—Mercy Hospital, Calvart and Saratoga Streets, plans by J. R. Edmunds, Jr., 409 Calvert Bldg., 8 story hospital building. $1,000,000.

Md., Baltimore—Oaklee Village, Inc., c/o J. E. Moxley, archt., 1722 Ellamont St., apartments. $250,000.

Mass., Worcester—F. W. Woolworth Co., 120 Tremont St., Boston, bids early September, 3 story, bsmnt., brick, steel, store bldg. $350,000.

Mich., East Lansing—Hillcrest Housing Corp., West Grand River, 50 homes, Hillcrest. $350,000.

N. J., Bayonne — Corp. forming, c/o C. Shilowitz, archt., 11 W. 42 St., New York, ninety 2 story, bsmnt. homes, W. 16 St. $450,000.

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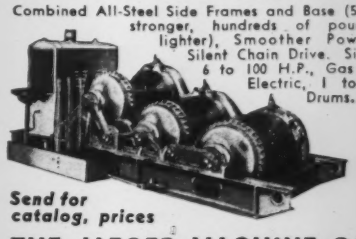

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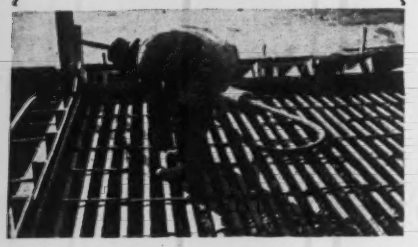

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COMMERCIAL BLDGS. (Proposed Work, Con.)

N. J., Fair Lawn—Midland Div. Corp., 45 Church St., Paterson, plans by S. Schenker, 195 Van Houten St., Paterson, 1 story, bsmnt., brick, stone, theatre, stores, Broadway. $500,000.

N. J., New Brunswick—St. Peters General Hospital, Eaton Ave., plans by Epple & Kahrs, 17 Washington St., Newark, 5 story, bsmnt., brick, steel hospital addn., Eaton Ave. $150,000.

N. J., Princeton—Construction List Corp., c/o L. C. Bowers, 180 Nassau St., forty 1½ and 2 story, bsmnt. homes, Cedar Lane. $280,000. McMurray & Schmidlin, 928 Styvesant Ave., Union, archts.

N. Y., Long Island City—B. Monte, 44 Court St., Brooklyn, plans by M. Hirsch, 44 Court St., Brooklyn, 6 story apartment, 49-11 Skillman Ave. $350,000.

★**N. Y., New York**—Ten Ten Park Ave. Corp., J. Peribinder, pres., 19 West 44 St., 19 story and penthouse apartment, Park Ave. and 85 St. **$1,500,000.** H. I. Feldman, 415 Lexington Ave., archt.

N. Y., New York—Walde Corp., 4141 Bway., plans by T. E. Heindsmann, 349 E. 149 St., 6 story, 93x102 ft., apartment, 219 St. and Bronx Blvd. $300,000.

Tex., Denison—T. J. Long & Associates, Denison, frame dwellings. $250,000.

★**Tex., Fort Worth**—M. E. Berney, F. A. Douglas and J. E. Gooch, c/o Waggoner Bldg., 600 one story brick dwellings, concrete fdns. $3,825,000.

Va., Newport News—Riverside Hospital. $334,000. Williams, Coile and Pipino, archts.

Wis., Marinette—Our Lady of Lourdes Cath. Cong., plans by L. A. Geniesse, 226 N. Washington St., Green Bay, church and convent, $150,000.

BIDS ASKED

Bids Asked September 2

Conn., Bristol—Bristol Hospital, Inc., Newell Rd., plans by C. S. Palmer, 75 Whitney Ave., New Haven, 4 story, brick, steel, hospital addn. $350,000. CD 8/22—ENR 8/28.

Bids Asked September 4

★**R. I., Warwick**—Palestine Temple of the Shrine, c/o Jackson, Robertson & Adams, archts., 1216 Turks Head Bldg., Providence, 3 story bsmnt., con., brick, stone, hospital, Buttonwoods Sect. $500,000. Office Hollis French, 210 So. St., Boston, engr. CD 7/17—ENR 7/24.

Bids Asked September 5

Tex., Dallas—Southern Methodist University, 1 and 2 story gymnasium. $150,000. CD 7/29—ENR 7/31.

Bids Asked September 8

Mass., Pittsfield—House of Mercy Hospital Corp., Mrs. H. D. Grinnell, pres., 100 Crofut St., Pittsfield, plans by P. W. Swern, 19 S. LaSalle St., Chicago, Ill., 5 story 50x100 ft., brick, steel clinical unit. P. 7341. $250,000.

Bids Asked

Conn., Bristol—Bristol Hospital, Inc., Newell Rd., plans by C. S. Palmer, 75 Whitney Ave., New Haven, 4 story, brick, steel, hospital addn. $350,000. C. S. Palmer, 75 Whitney Ave., New Haven, archt. CD 4/8—ENR 4/17.

Bids Asked

Ind., Gary—Holabird & Root, 333 N. Michigan Ave., taking bids, 2 story exchange, for Illinois Bell Telephone Co., 212 W. Washington, Chicago, Ill. $150,000.

CONTRACTS AWARDED

Calif., Richmond—R. J. Stempel, 1039 23 St., 1 story wood frame cottages to serve new shipyard area, day labor. **$150,000.**

Calif., Richmond—Flagg, Inc., 4300 Detroit Ave., Oakland, 1 story wood frame homes. Over **$150,000.** Owner builds.

Calif., Richmond—N. Wierk, 302 13 St., Oakland, 1 story wood frame homes. Day Work. Over **$150,000.**

Calif., San Francisco—Henkel & Tokin, 326 Shields Ave., 1 story, homes, vicinity Ramsell and Shields Ave. Day labor. Over **$150,000.**

Calif., San Francisco—Market Street Railway Co., 58 Sutter St., reconstr. brick car barns, for recreation center, to W. C. Tait, Inc., 863 Market St. **$180,000.** W. D. Peugh, 333 Montgomery St., archt. F. W. Kellberg, 320 Montgomery St., engr. CD 6/11—ENR 6/19.

Calif., Vallejo—Barrett and Hilp, et al, 918 Harrison St., San Francisco, commercial bldgs. **$150,000.** Owners build.

Calif., Vallejo—M. J. King, 231 Franklin St., 1 story homes near Mare Island Navy Yard. Day labor. Over **$150,000.**

Calif., Vallejo—V. Rasmussen, 2829 Divisadero St., San Francisco—1 story wood frame home vicinity Mare Island Navy Yard. Over **$150,000.** Day work.

★**Conn., North Haven**—T. A. Laydon, Obélan Rd., 1½ story, homes, Hartford Turnpike. Owner builds. **$500,000.**

Ill., Chicago Heights—Arman & Cook, 1637 Halstead St., 40 residences. Separate contracts. **$200,000.**

Kan., El Dorado—St. J[illegible] Home orphanage bldg., general contr[illegible] to Ed. Vollmer, 840 N. Main St., W[illegible] $165,500. plumb. and heating contract[illegible] ing & Heating Co., 912 E[illegible] Wichita. **$25,941.** CD 8/4.

La., New Orleans—Lake Co[illegible] one story frame cottages, Hay[illegible] New Orleans Airport, to Ger[illegible] Balter Bldg. **$167,244.** Awarde[illegible] Buys, 1514 Calhoun St., archt.

Mass., Quincy—L. Grossman [illegible] Sons, Inc., c/o M. Waters, archt., 24 Sch[illegible] St., Boston, 2 story 100x165 ft., brick, [illegible] community park center business bldg., to H. Jacobson, Inc., 16 Greenwood Ave. Est. $150,000.

Mo., St. Louis—Boulevard Frontage [illegible] 4222 Hampton Ave., 1 story [illegible] 50x178 ft. Hampton Village Market addn. Chippewa St. and Hampton [illegible] to A. H. Haesler Bldg. & Co[illegible] Palm St., plumbing to W. L. [illegible] Co., 11 N. Grand Blvd., c. F. Schlueter, 6329 San Bonita, Clayton, St. [illegible] archt.

N. J., River Edge—Artistic Bldg. Co., [illegible] Banta Pl., Hackensack, fifty 2 story [illegible] 24x32 ft. brick homes, Cherry Hill, J. N. [illegible] man Hunter, 405 Cedar Lane, Teaneck, archt. Separate Contracts. **$250,000.**

N. J., Tenafly—Country Homes, Inc. Hi[illegible] ard Park Dr., 33 two ½ story [illegible] homes. Separate Contracts. $297,000. [illegible] 8/14—ENR 8/21.

N. Y., Brooklyn—Dime Savings Bank of Brooklyn, 9-31 De Kalb Ave., [illegible] addn., to Edward Corning Co., 204 East 38 St., New York. Est. **$200,000.** CD [illegible] ENR 6/5.

N. Y., Brooklyn—Harman Building Corp., 163-18 Jamaica Ave., Jamaica, twenty six 1 family houses, Winthrop St., 23 and 24 St., owner builds. **$150,000.** A. E. Allen, 161 St., Jamaica, archt.

N. Y., Brooklyn—Madison Homes, Inc., 2168 East 36 St., thirty five 2 family houses, Minna St. and 12 Ave., owner builds. $[illegible] **500.** B. Driesler, Jr., 163 Remsen St., archt.

N. Y., Flushing—Gross Morton Garden Corp., 160-16 Jamaica Ave., thirty two family homes, 196 St., owner builds. $[illegible] CD 7/14—ENR 7/17.

★**N. Y., Lawrence Park**—E. J. Kalchein Building Corp., 22 E 40 St., New York, 148 residences, owner builds. $500,000.

N. Y., Long Island City—Esquire Queens Corp., 32 East 57 St., theatre, 42 St. and Queens Blvd., to Amusement Supply Co., Inc., 341 West 44 St., New York. Est. $150,000.

N. Y., New York—Gelson Realty Corp., 149 E. 149 St., 6 story, 105x118 ft. apartment, University Ave. near 195 St., separate contracts. Est. $215,000. CD 8/14—ENR 8/21.

O., Columbus—Beachwold Homes, Inc., East Broad St., 50 one story dwellings, East Royal Forest Blvd., and East Beechwold Blvd. to E. Elford & Sons Co., 355 South Front St. **$160,000.** Awarded August 11.

★**Pa., Erie**—Smith & Root, Erie Trust Bldg., 100 residences, separate contracts. **$500,000.** CD 8/6—ENR 8/14.

Pa., Phila.—Ideal Constr. Co., 12 S. 12 St., residential development, owner builds. **$150,000.** L. J. Cohen, Colonial Bldg., archt. and engr.

★**Pa., Phila.**—Kerr Constr. Co., 6701 N. Broad St., 236 residences, owner builds. **$700,000.**

★**Pa., Phila.**—M. Orleans, 801 W. Rockland St., additional residential development. M. Caplan, 801 W. Rockland St. Over $500,000.

★**Wyo., Thermopolis**—E. L. Smith & Associates, 7 story, brick, hotel to Green Brothers Worland, est. **$1,963,000.** Goodrick & Kreamark, Casper, archts.

INDUSTRIAL BUILDINGS

PROPOSED WORK

Ala., Fairfax—MILL—West Point Mfg. Co., West Point, Ga. 70,000 sq. ft. cotton mill addn. Robert & Co., Bona Allen Bldg., Atlanta, Ga., archts.

Ariz., Litchfield—PLANT—Goodyear Aircraft Corp., E. Market St., Akron, O., plant second unit, 200x500 ft., steel, brick to manufacture aeroplane parts, Litchfield Park.

Calif., San Diego—GENERATING PLANT—San Diego Consolidated Gas & Electric Co., 3 story, 120x150 ft., steel, electric generating plant. Samson St. $400,000.

Calif., San Francisco—PLANT—Atlas Heating & Ventilating Co., 557 4 St., San Francisco, wood frame construction, replacement of present plant. Over $40,000.

Calif., San Francisco—WAREHOUSE—Schenley Products Co., 600 Battery St., 4 story, rein.-con. warehouse, to Cahill Bros., 206 Sansome St., $44,000. W. D. Peugh, 333 Montgomery St., archt., F. W. Kellberg, 320 Market St., engr.

★**Conn., Bristol**—FACTORY—New Departure Div. General Motors, 269 N. Main St., Bristol, soon lets contract, 1 story, basic 160x583 ft., brick, steel, factory unit Plant. $500,000. A. Kahn, Inc., 345 Center Bldg., Detroit, Mich., engr.

INDUSTRIAL BLDGS. (Proposed Work, Cont.)

Conn., East Hartford—FREIGHT TERMINAL—McCarthy Freight System, Inc., 1209 Main St., completed plans, 1 story, brick, steel, freight terminal addn., Main St. $45,000.

Conn., Naugatuck—FACTORY—Peter Paul, Inc., New Haven Rd., 1 stoy, 80x175 ft. brick steel, candy factory. $53,000.

★**Idaho, Idaho Falls**—SMELTER—B. M. Rogers., smelter at Twin Buttes, 25 mi. west of here, $4,000,000.

★**Idaho, Kellogg**—FUMING PLANT—Bunker Hill & Sullivan Mining & Concentrating Co., fuming plant to recover lead, zinc and cadmium from smelter slag and fumes, $1,000,000. J. B. Haffner, gen. mgr., Kellogg, engr.

Ill., Aurora—PLANT—Western United Gas & Electric Co., Aurora, soon lets contract, addn. and alterations power plant. $500,000. Sargent & Lundy Inc., 140 S. Dearborn St., Chicago, engrs. CD 7/15—ENR 7/17.

Ill., Chicago—GARAGE—Owner, c/o Rawson & Eisenberg, 4930 W. Adams St., archt., bids soon, 1 story, 85x200 ft. garage and truck terminal. Lowe and 26 St. $50,000.

Ind., Fort Wayne—FACTORY—Zollner Machine Co., new brick, steel, factory to double capacity. $300,000 or more with equip.

★**Ia., Muscatine**—GENERATING PLANT—First Iowa Hydro-Electric Co-operative, hydro-electric generating plant. $13,500,000. Hubbard Engineering Co., Chicago, engr.

La., Shreveport — REFINERY — Brown-Strauss Corp., 1446 Guinotte St., Kansas City, Mo., and Shreveport, imprv. to refinery plant at Cedar Grove, c/o Ref. Co. $100,000.

Minn., Pine City — BOTTLING PLANT — Coca-Cola Bottling Co., bids early fall, bottling plant. $80,000. T. J. Shefchik, 307 Lansdale Bldg., Duluth, archt.

Md., Baltimore—WAREHOUSE, etc.—Alban Tractor Co., 725 E. 25 St., soon lets contract, 1 story, 100x100 ft., brick, steel warehouse, shop office, concrete fdn. $100,000. CD 6/11—ENR 6/19.

N. J., Clifton—MANUFACTURING BUILDING—Brighton Mills Co., 55 Brighton Rd., 2 story, brick, steel, manufacturing bldg. $253,942.

N. J., Clifton—TERMINAL AND GARAGE—Passaic Athenia Bus Co., 541 Main Ave., plans by J. T. Camlet, 667 Main Ave., 1 story, part bsmnt., 75x100 ft. and 50x50 ft., brick, concrete block bus terminal and garage, Clifton Ave.

N. J., Hillside—WAREHOUSE—Wheelock Lovejoy Co., 128 Sidney St., Cambridge, Mass., plans by Ganteaume & McMullen, 99 Chauncey St., Boston, Mass., bids soon, 1 story 100x200 ft., brick, steel, warehouse, Park St. $100,000.

N. J., Linden—Virginia Dare Extract Co., 882 3 Ave., Brooklyn, N. Y., plans by J. J. Gloster & Co., 303 W 42 St., New York, N. Y., brick, steel factory, Route 25. CD 8/19—ENR 8/25.

N. J., New Brunswick—PLANT—Empire Photo-Engraving Co., 76 Church St., plans by A. Merchant & Son, 1 Elm Row, 1 story, bsmnt., 50x100 ft., brick, stucco on concrete blocks photo engraving plant, Church St.

N. J., Penns Neck—LABORATORY BUILDING—R. C. A. Corp., Front and Cooper Streets, Camden, laboratory, $1,000,000.

N. Y., Brooklyn—PLANT—Bay Ridge Dock Co., Inc., 57 St., soon lets contract, 1 story, 50x130 ft. plant addn. and 4 story 50x130 ft., rein.-con., brick building. $250,000. W. Higginson & Son, 101 Park Ave., New York, archts.

N. C., Durham—BUS TERMINAL—J. M. Edwards, archt., 102 W. Hargett St., Raleigh, soon lets contract, bus station, Main and Dillard Sts., for Carolina Coach Co., lessee. $75,000 to $100,000. Bid date extended. CD 8/13—ENR 8/28.

N. C., Greensboro—BUS TERMINAL—Atlantic Greyhound Corp., Kanawha Valley Bldg., Charleston, W. Va., plans by G. Brown, Winston-Salem, N. C., c/o owner, bids in 60 days, bus terminal. $100,000. CD 10/14/40—ENR 10/17/40.

O., Cleveland—ICE CREAM PLANT—Howard Johnson Restaurant & Ice Cream Co., 89 Beale St., Boston, Mass. plans by Dickerson & Barrett, 3030 Euclid Ave., 2 story ice cream plant brick, rein.-con. $60,000.

O., Cleveland—FACTORY, etc.—S. K. Wellman Co., J. W. Wellman, pres., 1381 E. 49 St., plans by C. B. Rowley & Assoc., Keith Bldg., 1 and 2 story, 155x176 ft., brick steel factory and office bldg. $80,000. CD 2/7—ENR 2/13.

Ore., Pendleton—EXCHANGE—Pacific Tel. and Tel., J. A. Murray Pendleton Dist. mgr., 1 story, bsmnt. 80 ft. square, exchange bldg., SW 1 St., and SW 2 St.

Pa., Erie—BOILER HOUSE — Hammermill Paper Co., A. S. Goodrich, ch. engr., East Lake Rd., bids soon, 1 story, bsmnt., 40x50 ft., brick, steel boiler house exten. O. C. Schoenwerk, 3240 North Lake Shore Dr., Chicago, Ill., consult. engr.

Pa., Franklin—PLANT—Joy Mfg. Co., plant addn., Buffalo St. Over $60,000.

Pa., Lock Haven—OFFICE—American Aniline Products, Inc., Dr. T. James, techn., dir., in chg.; second story addn office, boiler house, installing new turbo generators, mg. unit, processing purposes. $320,000.

Tenn., Memphis—PLANT and WAREHOUSE—Producers Warehouse and Compress Co., compress plant and warehouse. $100,000.

Tex., Brownwood — PLANT — Brownwood Farmers & Homemakers Market, c/o H. G. Lucas, Brownwood, sweet potato curing plant.

Tex., Gilmer—PLANT—Mirror Co., plans by N. L. Peters, Longview, 1 story, 40x120 ft., brick, concrete fireproof, mirror mfg. plant.

★**Tex., Grand Prairie**—PLANT—North American Aviation, Inc., Grand Prairie, flight test building, ramps, concrete storage building, garage, etc. $1,314,972. Allen & Kelly, Indianapolis, engrs.

Wis., Washington Island — GENERATING PLANT—Washington Island Elec. Co-op. Inc., diesel generating plant. $51,000. Wisconsin Development Auth., 602 Tenney Bldg., Madison, engr.

N. S., Sydney—FACTORY—Chappells Ltd., Sydney, wood working factory. $100,000.

Ont., Brantford—PLANT — Canadian Durex Abrasives, Ltd., 154 Pearl St., Toronto, bids soon, plant exten. $300,000.

Ont., London — FACTORY — Kelvinator of Canada, C. W. Hadden, mgr., Dundas St. E., plans 1 story, 45x250 ft., brick, steel factory. $75,000.

Ont., Oshawa—PLANT—General Motors of Canada, Ltd., Oshawa, plans 1 story, 20x160 ft., brick, steel plant addn. $200,000.

★**Ont., Owen Sound**—MOLDING SHOP—W. Kennedy & Son, plans by E. A. Leigh, 859 2 Ave. E., Owen Sound, Ltd., 21 First Ave., molding shop. $500,000.

Que., Cap de la Madeleine—PLANT—Electric Steel, Ltd., St. Laurent St., plant. $475,000.

Que., Farnham—PLANT—J. M. Robertson, archt., 1396 St. Catherine St. W., Montreal, soon lets contract 1 story, 32x400 ft., rein.-con., brick plant and garage addn., for Collins & Aikman Co., Ltd., Farnham. $125,000.

Que., Longueuil — PLANT — Canadian Pratt & Whitney Co., Ltd., 14 Lorne St., plans by E. J. Turcotte, 1010 Ste. Catherine St. W., Montreal, altering and building 1 story, 55x110 ft., wood addn., concrete fdn. $100,000.

Que., Quebec City — MACHINE SHOP — Morton Eng. & Dry Dock Co. Ltd., Louise Embankment, 60x160 ft., steel superstructure machine shop, concrete fdn., banks of St. Charles River. $350,000.

BIDS ASKED

Bids Asked September 1

Ia., Waterloo — FACTORY — Rath Packing Co., new buildings, present bldg. addn. Over $150,000. Henschein, Everds & Crombie, 59 E. Van Buren St., Chicago, Ill., engrs.

O., Cincinnati — BUS TERMINAL — Greyhound Terminal, 630 Walnut St., plans by Wischmeyer, Arrasmith & Wlswick, Heyburn Bldt., Louisville, Ky., bus terminal, 5 and Sycamore St., $325,000. CD 6/10—ENR 6/12.

Bids Asked September 2

Ont., Toronto (Mimico)—SHOPS, etc.—Canadian Natl. Rys., T. T. Irving, ch. engr., Central Region, Union Station, Toronto, exten. 5 stalls engine, casting shop. $50,000.

Bids Asked September 3

Mass., Waltham—WAREHOUSE—Middlesex County Farm Bureau, Assoc., 13 Lexington Ave., 2 story, 52x110 ft., brick, conc., warehouse and offices. $40,000.

Tex., Houston—PLANT—Rath Packing Co., J. S. Bartley, ch. engr., Waterloo, Ia., 2 story, 45x58 ft. wings with second story addn. to present 100x100 ft. building, tile, brick, stone. $100,000.

Bids Asked September 7

Wis., Genoa—POWER PLANT ADDITION—Tri-State Power Co-op, one and 3 story, 100x200 ft. superstructure power plant addn., Rural Line Engineers, Clayton, Mo., engr. CD 6/18—ENR 6/26.

Bids Asked

Conn., Hartford—FACTORY—Maxim Silencer Co., 58 Homestead Ave., 1 and 2 story, 100x130 ft., and 1 story 35x100 ft., brick factory addn., Homestead. $120,000. Buck & Buck, 650 Main St., engrs.

Ill., Chicago—PRINTING PLANT—Theilbar & Fugard, 520 N. Michigan Ave., archt., taking bids, 1 story, 100x110 ft. printing plant addn. $40,000.

Ill., Skokie—FACTORY—Biwax Corp., 1017 S. Kalmar Ave., 1 story, 100x120 ft. factory, Howard St. $50,000.

Ind., Whiting—PLANT—American Smelting & Refining Co., 1 story plant addn., Indianapolis Blvd., $100,000.

N. J., Clifton—TERMINAL—Passaic Athenia Bus Co., 541 Main Ave., plans by J. T. Camlet, 667 Main Ave., 1 story, part bsmnt., 75x100 and 50x50 ft., brick, concrete block bus terminal and garage, Clifton Ave. CD 8/20—ENR 8/28.

N. Y., Buffalo—FACTORY—National Aniline & Chemical Co., Inc., 105 S. Park Ave., factory. $100,000.

R. I., Newport—BOTTLING PLANT—Peter Faeber & Sons, Inc., 24 Bath Rd., plans by C. Dutra, 1 Spring St., 1 and 2 story, bsmnt.,

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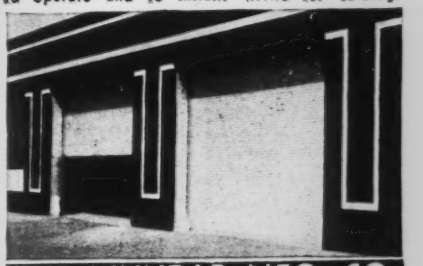

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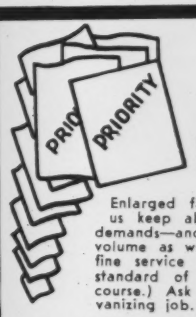

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INDUSTRIAL BLDGS. (Bids Asked, Cont'd.)

50x120 ft., concrete blocks, brick soda bottling plant, con. fdn. $40,000 with equip.

Ont., Kitchener—WASHING PLANT—B. A. Jones, archt., 125 King St. W., taking bids 2 story, 65x125 ft., brick, steel keg washing plant, for Blue Top Brewing Co., W. P. Renaud, gen. mgr., 476 King Ct. W. $60,000.

Ont., Toronto—PLANT—R. W. Sherriff, archt., 3 Lacauley St., taking bids plant addn. for Canadian Wirebound Boxes, Ltd., 1000 Gerrard St. E. $60,000.

LOW BIDDERS

D. C., Wash.—PLANT—Washington Beef & Produce Co., 440 11 St. S.W., 2 story, 50x200 ft. packing plant, from Mohler Constr. Co., 1223 Connecticut Ave. Est. $40,000. CD 5/21—ENR 5/29.

CONTRACTS AWARDED

★**Ariz., Litchfield Park**—PLANT—Goodyear Aircraft Corp., E. Market St., Akron, O., first unit, 200x500 ft. steel brick plant for manufacture aeroplane parts, Litchfield Park, to P. W. Womack Constr. Co., 600 E. Jefferson St. **$500,000.** CD 8/1—ENR 8/7, under Phoenix.

Calif., East Nicolaus—SUBSTATION—Pacific Gas & Electric Co., 245 Market St., substation bldg., transformer repair house, to MacDonald & Kahn, Financial Center Bldg., over **$60,000.**

Calif., Oakland—GARAGE—Remmer & Jordan, 40 Ave. and E. 14 St., one story brick garage, to H. L. Risdon & Sons, 5977 Majestic Ave., **$48,500.**

Calif., Redwood City—GARAGE—Davies Auto Co., 1101 El Camino Real, garage with shop units, day labor. **$45,000.**

Calif., San Francisco—STORAGE—Raineir Brewing Co., 15 and Bryant St., rein.-con. storage addn., to Engineers, Ltd., 225 Bush St., **$50,000.** K. Theill, 580 Market St., engr.

Calif., San Jose—WAREHOUSE—Mutual Grocery Co., 340 North San Pedro St., rein.-con. warehouse, to Pasetta Constr. Co., 2390 Park Ave., Santa Clara, **$43,860.**

Colo., Denver—WAREHOUSE—John Deere Plow Co., 1401 W 13 St., Kansas City, Mo., warehouse, to F. J. Kirchhof Constr. Co., 700 Lawrence St. Est. **$90,000.** CD 8/5—ENR 8/7.

Conn., Bridgeport—TOOL PLANT—Automatic Machine Co., 136 E. Washington Ave., brick, steel, con., alterations, machine tool plant, E. Washington Ave., to DeFonce Constr. Co., 51 Hurd Ave. **$60,000.**

Conn., Bridgeport—WAREHOUSE—Bullard Co., 1 story warehouse 60x156 ft., Blackrock Rd., to Turner Constr. Co., 420 Lexington Ave., New York. Est. **$75,000.** A. D. Crosett, 512 5 Ave., New York, engr.

Conn., Clinton—WAREHOUSE—Ponds Extract Co., 1 story 80x200 ft. and 1 story 80x125 ft., concrete warehouse units, to H. Wales Lines Co., 134 State St., Meriden. Est. **$40,000.** F. L. Smith, 21 E. 40 St., New York, archt.

Conn., Hartford—FACTORY—Hanson Whitney Machine Co., 169 Bartholomew Ave., 2 story brick, steel, light factory unit, Bartholomew Ave., to Bartlett & Brainard Co., 103 Woodbine St. **$74,000.** J. T. Henderson, 750 Main St., engr.

Conn., Hartford—GARAGE—Southern New England Telephone Co., 227 Church St., New Haven, 1 story 70x100 ft., brick, steel, service garage, Albany Ave., to Industrial Constr. Co., 721 Main St. Est. **$55,000.** CD 7/29—ENR 7/31.

Conn., New Britain—WAREHOUSE—Simonds Estate, c/o M. S. Gordeon, 278 Main St., 1 story 42x240 ft. and 70x105 ft., brick, steel, warehouse, Myrtle Ave., separate contracts, $60,000. Horace Ginsbern, 205 E. 42 St., New York, archt. CD 8/5—ENR 8/7.

Conn., Rockville—TEXTILE MILL—M. T. Stevens & Sons Co., 155 West Main St., 1 story 45x150 ft., brick mill addn., to R. E. Runels Constr. Co., 24 Merrimack St., Lowell. Est. **$45,000.**

Ill., Chicago—FACTORY—Borge & Beck Co., 3558 S. Menard Ave., 1 and 2 story, factory, 66 St. and Menard Ave., to Enjay Constr. Co., 160 N. LaSalle St. Est. **$200,000.**

Ill., Chicago—POWER PLANT—Commonwealth Edison Co., 72 W. Adams St., Unit 17, Fisk St. power plant, to Herlihy Mid Continent Co., 140 S. Dearborn St., Shaw, Maess & Murphy, 80 E. Jackson Blvd., archts.

Ill., Chicago—FACTORY—Golf Ball, Inc., 5816 S. Lowe Ave., 2 story, bsmnt., 75x125 ft. sporting goods factory, **$50,000.** A. H. Spitz, 220 S. State St., archt. Separate Contracts.

Ill., Chicago—FACTORY—Hollup Corp., 3357 W. 47 Pl., factory addn., 4700 W. 19 St., to Campbell, Lowrie & Lantermulch, 400 Madison Ave. Est. **$250,000.**

Ill., Chicago—PLANT—Horween Leather Co., 2015 Elston Ave., 1 story 65x250 ft., plant addn., to E. L. Archibald Co., 11 S. LaSalle St., Chicago. Est. **$40,000.** Dubin & Dubin, 127 N. Dearborn St., archt.

Ill., Chicago—WAREHOUSE—Transparent Package Co., 1019 W. 35 St., 2 story, 150x250 ft., office and warehouse, 3530 S. Morgan St., to E. W. Sproul Constr. Co., 2001 W. Pershing Rd., est. **$300,000.** A. Epstein, 2001 W. Pershing Rd., archt. and engr.

Ill., Chicago Heights—PLANT—Victor Chemical Co., 14 W. Jackson St., Chicago, 3 story 75x110 ft., plant addn., to J. W. Snyder Co., 307 N. Michigan Ave., Chicago. Est. **$75,000.**

Ill., Cicero—WAREHOUSE—Western Electric Co., Cicero and Cermak Rds., Cicero, 1 story warehouse, 66 St., to Austin Co., 510 N. Dearborn St. Est. **$100,000.** CD 8/15.

Ill., Downers Grove—PLANT—Rite-Rite Mfg. Co., 1501 W. Polk St., Chicago, 1 story, 100x200 ft., plant to Schless Constr. Co., 236 N. Clark St., Chicago. Est. **$75,000.** G. H. Buckley, 644 N. Michigan Ave., archt.

Ill., Forest View—WAREHOUSE—Pure Oil Co., 35 E. Wadar Dr., Chicago, office and warehouse, to Person Constr. Co., 130 N. Wells St., Chicago. Est. **$150,000.**

Ill., Stickney—WAREHOUSE—U. S. Chemicals, Inc., 380 W. 38 St., Chicago, 2 story 150x200 ft. warehouse, to W. J. Barney Corp., 101 Park Ave., New York. Est. **$175,000.**

Ia., Cedar Rapids—BOILER PLANT—Iowa Electric Light & Power Co., Security Bldg., new boiler unit, to Paulsen Construction Co., Cedar Rapids. Over **$50,000.** CD 3/4—ENR 3/6.

Md., Baltimore—STOCKHOUSE—National Brewing Co., Conkling and O'Donnell Sts., 2 addnl. stories, stock house, approx. 50x90 ft., to Leimbach & Williams, 26 W. Bidder St., **$50,000.** CD 6/16—ENR 6/17.

Mass., Everett—FACTORY—Barwood Mfg. Co., Inc., Williams St., 1 story 52x164 ft., brick, steel factory, Williams and Norman Streets, to James Sheppard, 225 Vine St. Est. **$40,000.** Hutchins & French, 11 Beacon St., Boston, archt.

Mass., Quincy—MILK PLANT—White Brothers, 50 French St., 2 story, 125x155 ft., air conditioned milk plant addn., incinerator, French St., **$125,000.** Separate contracts. W. D. Luke, 19 Warner St., West Somerville, engr.

Mich., Detroit—FACTORY—Burroughs Adding Machine Co., 6071 2 Blvd., Detroit, 1 story brick, steel, rein. con. factory bldg., to Esslinger-Misch Co., 159 E. Columbia St. Est. **$195,000.** A. Kahn, Inc., New Center Bldg., archt.

Mich., Detroit—FACTORY—St. Claire Tool Co., 621 Beaufait St., 1 story brick, steel, concrete, tool die shop factory, to Cooper Constr. Co., 5057 Woodward Ave. Est. **$50,000.** H. E. Beyster, Corp., General Motors Bldg., engr.

Mich., Kalamazoo—FACTORY and WAREHOUSE—Upjohn Co., 1 story 150x280 ft. brick, steel factory and warehouse for chemical plant to Miller-Davis, Kalamazoo. Est. **$75,000.**

Minn., Minneapolis—GRAIN ELEVATOR ADDITION—Leval & Co., 581 Chamber of Commerce Bldg., P. Doyne, mgr., 50x342 ft., grain elevator addn. Marshall Ave. and 23 Ave., S.E. to Jones-Hettelsater Constr. Co., 600 Mutual Bldg., Kansas City, Mo. **$250,000.**

Mo., St. Louis—GARAGE—Federal Facilities Realty Trust, 100 W. Monroe St., Chicago, Ill., 1 story 180x300 ft., brick garage, to R. C. McCormack, Inc., 16 Gast Pl. Est. **$40,000.** A. S. Alschuler & R. N. Friedman, 28 E. Jackson Blvd., Chicago, Ill., archts.

Mo., St. Louis—MILL—Mississippi Woodworking Co., 4838 Theodosia, 1 and 2 story, 50x50 ft., and 86x106 ft., brick planing mill. **$40,000.** Owner builds.

★**N. J., Bendix**—FOUNDRY—Bendix Aviation Corp., South Bend, Ind., 180x400 ft., brick, steel, magnesium foundry, to Austin Co., 19 Rector St., New York. Est. **$500,000.** CD 5/26—ENR 5/29.

N. J., Bridgewater—MANUFACTURING—Singer Sewing Machine Co., Trumbull St., Elizabeth, 1 story, 400x600 ft., brick, steel and glass manufacturing, to The Austin Co., 19 Rector St., New York. **$400,000.**

N. J., Hillside—PLANT—Bristol Myers Co., 5 story, steel, rein.-con., plant to Wigton-Abbot Corp., Plainfield. Est. over **$40,000.**

N. J., Montclair—MILK DEPOT—Borden Farm Products Co., 110 Hudson St., New York, 1 story, brick, structural glass, Milk Depot, alterations, Glenridge Ave., to Equity Constr. Co., Inc., 25 W. 43 St., New York. **$50,000.** H. B. Lindeberg, 110 Hudson St., New York, Co. archt.

N. J., Nutley—ADMINISTRATION BLDG.—Hoffman-LaRoche Inc., Kingsland Rd., steel administration bldg., to White Constr. Co., 95 Madison Ave., New York. Est. **$400,000.** CD 3/10—3/13.

★**N. J., Nutley**—LABORATORY—Hoffman La Roche Inc., Kingsland Rd., brick steel research laboratory to White Constr. Co., 95 Madison Ave., New York, Est. **$500,000.** Fellheimer & Wagner, 155 E. 42 St., New York, archts. CD 2/18—ENR 2/20.

N. J., Passaic—PLANT—Okonite Co., Canal St., 2 story, 60x140 ft., brick, steel, plant addn., Canal St., to F. L. Dillen Constr. Co., 75 Church St., Lodi. **$70,000.**

N. J., Rahway—L. Merck & Co., 126 E. Lincoln Ave., 2 story, bsmnt., 50x100 ft., brick, steel, concrete, research chemistry laboratory, Lincoln Ave., to W. Kidde Constr. Inc., 140 Cedar St., New York. CD 7/15—ENR 7/17.

N. Y., Brooklyn—WAREHOUSE—Brillo Mfg. Co., 205 Water St., altering 4 story warehouse and office building, 183-85 Plymouth St., separate contracts. Est. **$40,000.** CD 7/25—ENR 7/31.

N. Y., Brooklyn—STOCK HOUSE—F. & M. Shaefer Brewing Co., 430 Kent Ave., 8 story, 89x120 ft., steel, rein.-con. stock house, 448 Kent Ave., to Turner Constr. Co., 420 Lexington Ave., New York City. Est. **$300,000.** CD 11/15.

N. Y., Brooklyn—WAREHOUSE—Bush Terminal Co., 100 Broad St., New York, N. Y., altering 4 story warehouse, 43 St. near 1st Ave., to Higginson-Johnstone Co., 18 E. 48 St., New York. Est. **$120,000.** CD 8/15—ENR 8/21.

N. Y., Corona—GARAGE—F. Reinz[illegible] 33-37 Grand Ave., Elmhurst, 1 story, gara[illegible] gas station and repair shop, Horace [illegible]ding Blvd. near W. 94 St., separate [illegible]acts. **$50,000.** CD 8/18—ENR 8/21.

N. Y., Jamestown—PLANT—Rane [illegible] Co., Inc., 17 Ross St., 55x100 ft. factory, [illegible] Ware-ren Constr. Co., Inc., 335 Steele St. Est. **$40,000.** CD 7/21—ENR 7/24.

N. Y., Niagara Falls—PLANT—Great Lakes Carbon Corp., Pine Ave., 70x200 ft. plant addn., to Laur & Mack Contg. Co., [illegible] College Ave. Est. **$50,000.** A. L. Williams, c/o owner, engr.

N. Y., Niagara Falls—PLANT—Niagara Alkali Co., 4205 Buffalo Ave., land 2 story, 70x200 ft., 70x142 ft., and 24x35 ft., plant [illegible]ddns., to Gaylord S. Guenthert Co., 611 8 St. Est. **$40,000.**

N. C., Burlington—PLANT—Coca Cola Bottling Co., 2 story, 75x100 ft., brick, steel plant, Main St., to Jno. H. Bonitz, Greensboro. Over **$75,000.** C. C. Hartmann, Greensboro, archt.

Pa., Bridgburg—FACTORY—Chas. Leuzinger & Co., Inc., Richmond St., 4 story, 45x[illegible]60 ft. and 3 story 45x166 ft. factory, to Frank V. Warren, Inc., 15 and Locust Sts., Phila. Est. **$150,000.** Davis & Dunlap, Sansom St., Phila., archts.

Pa., Danville—PLANT—Kennedy Van Saun Mfg. & Eng. Co., Danville, 100x200 ft. manufacturing building, to Austin Co., 19 Rector St., New York, N. Y. $75,000.

Pa., Erie—WAREHOUSE—American Hollow Boring Co., C. E. Mueller, gen. mgr., 1 story, 60x120 ft. brick, steel, warehouse addn., to Sessinghaus & Ostergaard, Inc., 1115 Peach St., Myers & Johnson, 821 Commerce St., archts.

Pa., Erie—WAREHOUSE—Hays Mfg. Co., 801 W. 12 St., 1 story, 50x200 ft., steel, concrete, warehouse, to Henry Platt Co., 922 Raspberry St. Est. **$40,000.** H. Nelson, Hayes Bldg., engr.

Pa., Grove City—SHOP, etc.—Wilson, Grove City and New Castle, 1 story, 60x132 ft. shop and 20 plane hangar, at Grove City Airport, separate contracts. **$40,000.**

Pa., Phila.—WAREHOUSE—Fogel Refrigerating Co., Kennedy St., 65x315 ft. warehouse, to C. Litman, Mifflin St. Est. **$40,000.**

Tenn., Chattanooga—PLANT—American Lava Co., 4 story bldg., plant addn., to M. K. Wilson, Loveman Bldg., Chattanooga. **$68,000.** W. H. Sears, James Bldg., archt.

Tex., Baytown—PLANT—Humble Oil & Refining Co., Baytown, enlarging aviation gasoline plant. Force account, **$250,000.** CD 8/13—ENR 8/21.

Tex., Fort Worth—PLANT—Fort Worth Poultry & Egg Co., J. B. Collier, Jr., pres., egg drying plant. Own forces. **$89,000.**

Tex., Houston—GARAGE, etc.—Emsco Derrick & Equipment Co., Garden Villas, gate and garage, each 1 story, 30x80 ft., to T. D. Howe, c/o owner. **$45,000.**

Man., Transcona—SHOPS—Canadian Natl. Ry., H. A. Dixon, ch. engr., Western Region, Winnipeg, repairing shops, to G. A. Baert, 201 Des Meurous St. S., Boniface. **$40,000.** CD 7/12—ENR 7/25.

Ont., East Windsor—PLANT—Ford Motor Co. of Canada, Ltd., East Windsor, 60x224 ft. concrete, wood, drive away building, also 69x100 ft. addn., to Dinsmore, McIntire, Ltd., Windsor. **$57,000.**

Ont., Hamilton—PLANT—Wallace Barnes Co., Ltd., 274 Sherman Ave., 1 story, 60x230 ft. rein.-con., brick, addn., concrete fdn., to W. H. Cooper Constr. Co., Ltd., Medical Arts Bldg. **$50,000.**

Ont., Hamilton—PLANT—Hamilton Bridge Co., Bay St., N., steel and corrugated iron plant, own forces. **$135,000.**

Ont., Malton—PLANT—National Steel Car Corp., Kenilworth St. N., Hamilton, plant addn., to Gratton Constr. Co., 486 Clinton St., Toronto. Est. **$100,000.** L. Husband, 1 S. James St., Hamilton, archt.

Ont., Peterborough—PLANT—Brinton-Peterborough Carpet Co., Ltd., Factory Lock, plant exten., to T. C. Ephgrave, 310 London St. Est. **$40,000.**

Ont., Sandwich—ABATTOIR—Sheppard & Masson, archts., 52 Chatham St., Windsor, abattoir, for Royal Packing Co., c/o L. R. Cumming, Canada Bldg., Windsor, to S. Bersch, 710 Giles St., Windsor. Est. **$66,000.** CD 8/13—ENR 8/21.

★**Ont., Toronto**—PLANT—De Haviland Aircraft of Canada, Ltd., exten. Plant 2, Sheppard Ave. W. of Defferin St., North York Twp., to A. W. Robertson, Ltd., 57 Bloor St. W. Est. **$1,000,000.** CD 7/25—ENR 7/31.

Ont., Windsor—PLANT—Ford Motor Co. of Canada, W. R. Campbell, genl. mgr., 2780 Sandwich St., 1 story, 60x224 ft., and 1 story, 67x100 ft., frame plant addns., to Hein Constr. Co., 172 Sylmer Ave. Est. **$57,000.**

Que., Montreal—PLANT—Canadian Car & Fdry. Ltd., Notre Dame St. E., plant addn., to Foundation Co. of Canada, Ltd., 1538 Sherbrooke St. W. **$68,000.**

Que., Montreal—SHOP—Spence, Mathias & Burge, archts., 2063 Union Ave., addn. to Shop No. 6, Turcot Plant, for Canadian Car & Fdry. Co., Ltd., 621 Craig St., W., to Foundation Co., Ltd., 1538 Sherbrooke St., W. **$68,000.** CD 8/5.

Que., Noranda—MILL—Mic-Mac Mines, Ltd., Royal Trust Bl., 105 S. James St. W., 500 ton per day ore mill, Bouquet Twp., to Anglin-Norcross (Quebec) Ltd., 57 Bloor St. W., Toronto, Ont. Est. **$100,000.** CD 7/19—ENR 7/29.